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JOURNAL

OF

GAS LIGHTING,

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AND

SANITARY IMPROVEMENT.

VOL. LXXV.

January to June, 1900.

LONDON:

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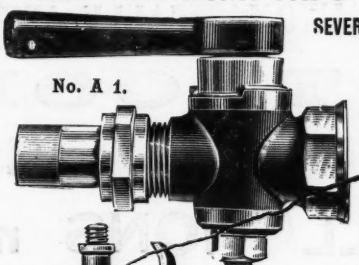
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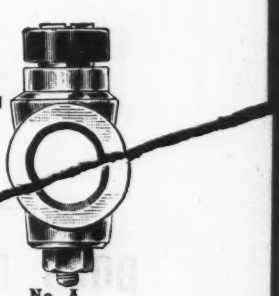
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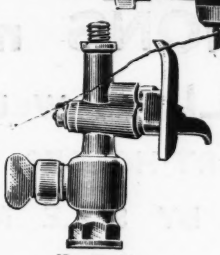
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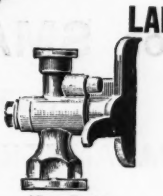
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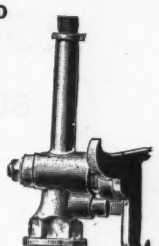
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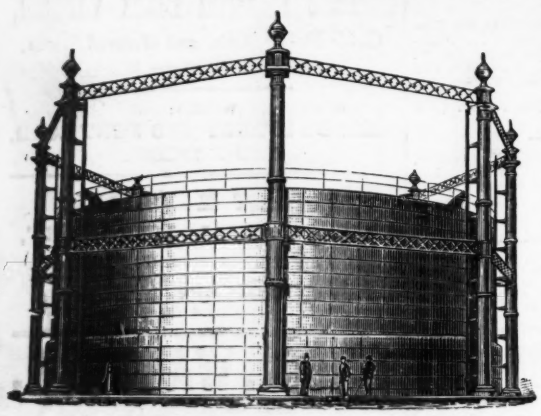

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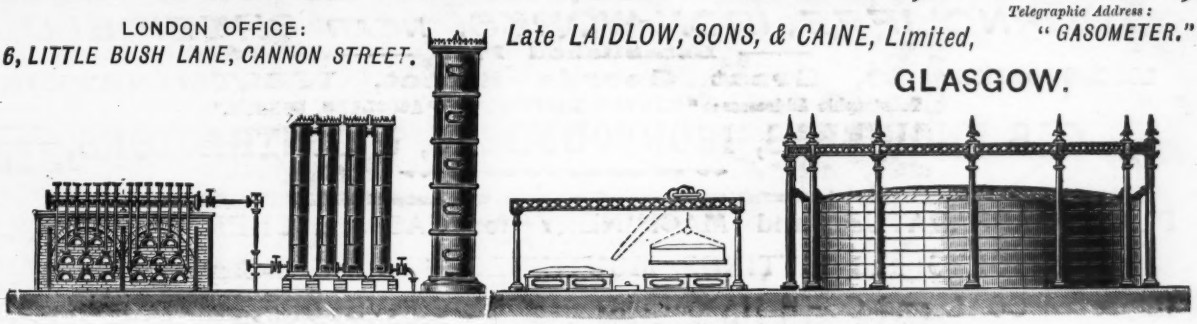

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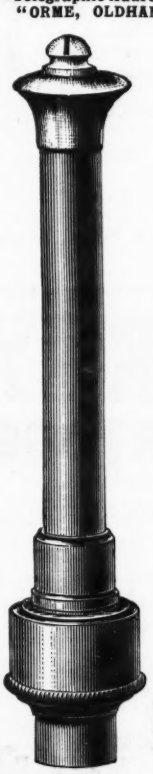

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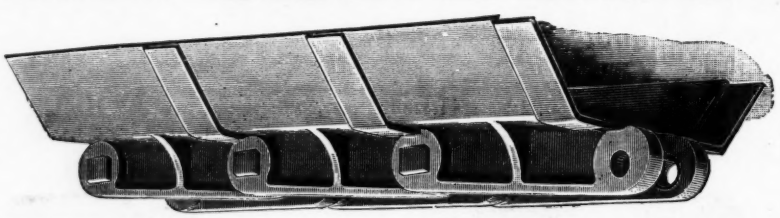

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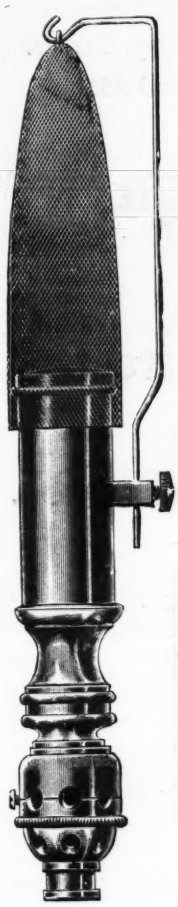

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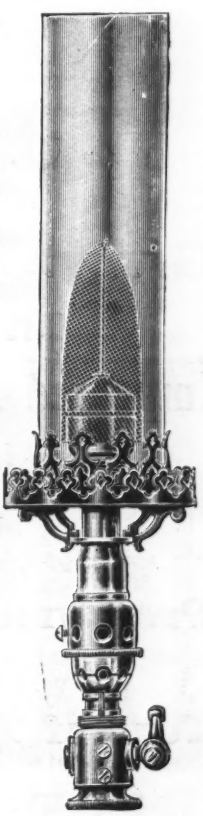

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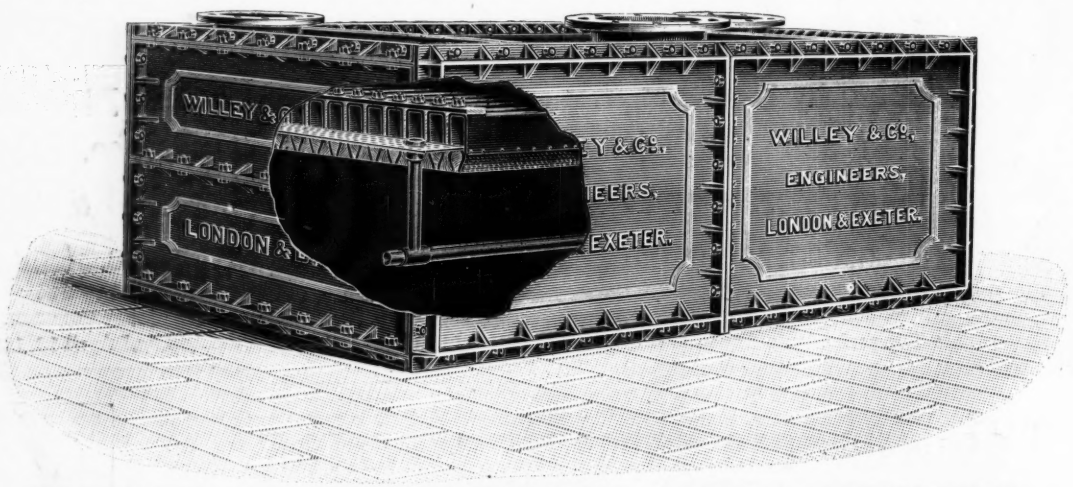

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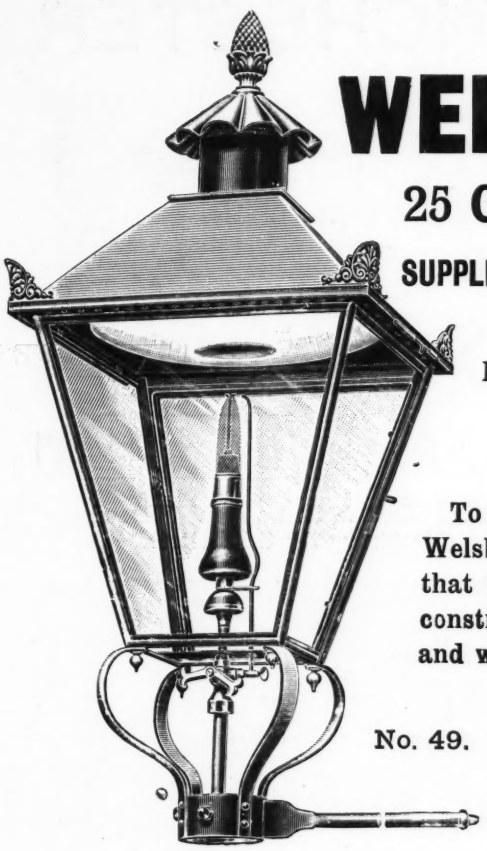

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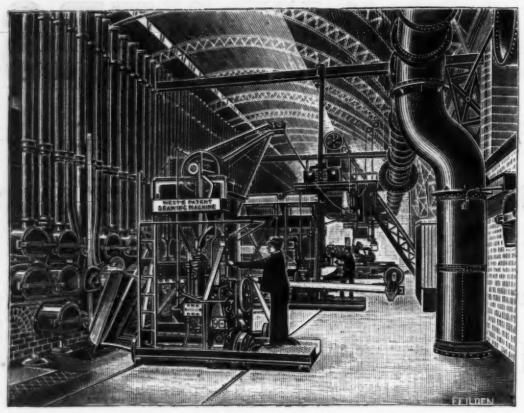

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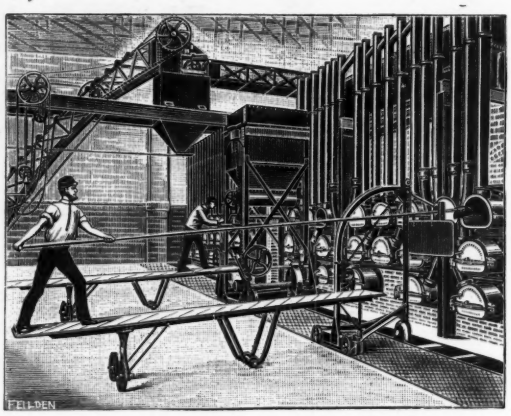

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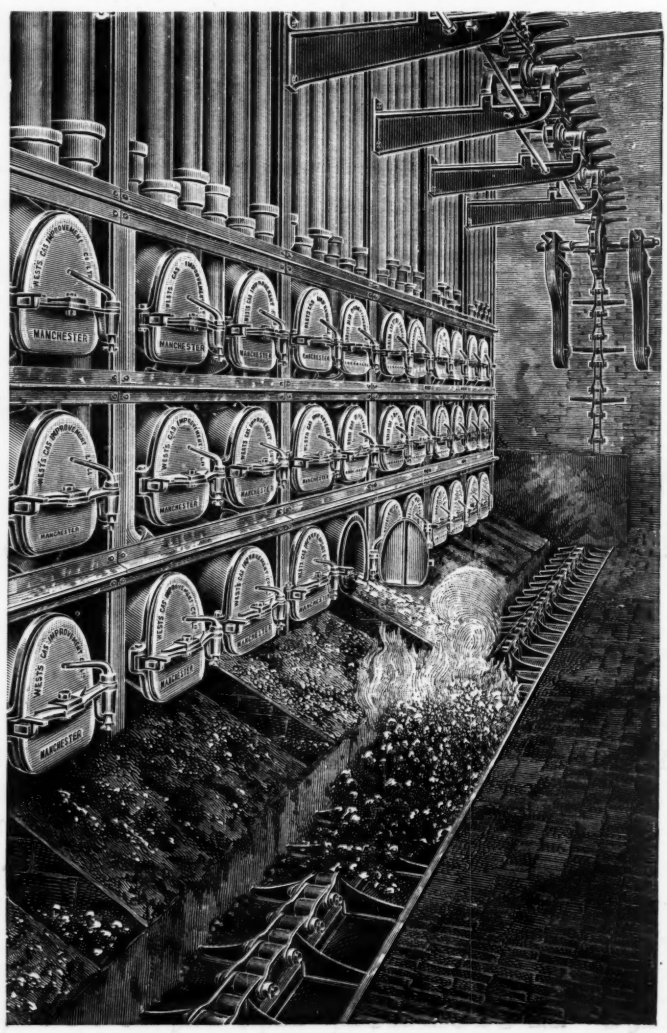

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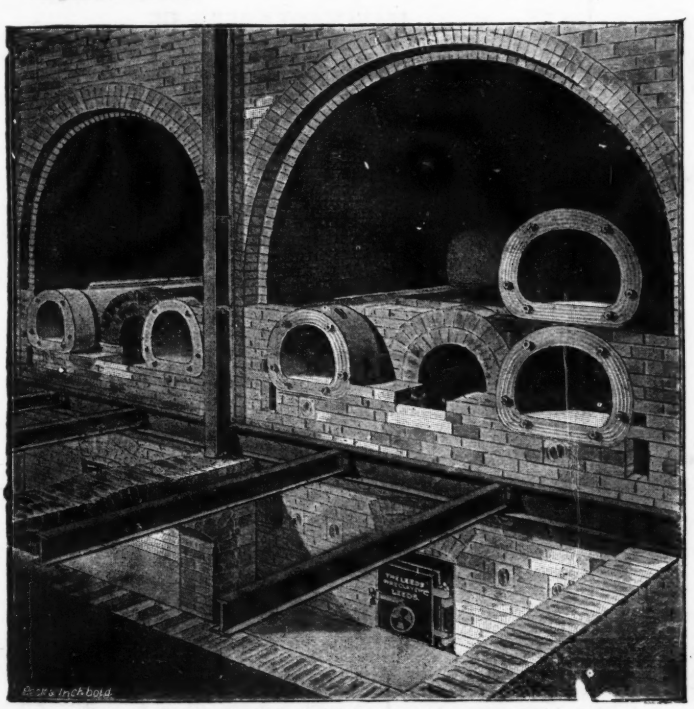

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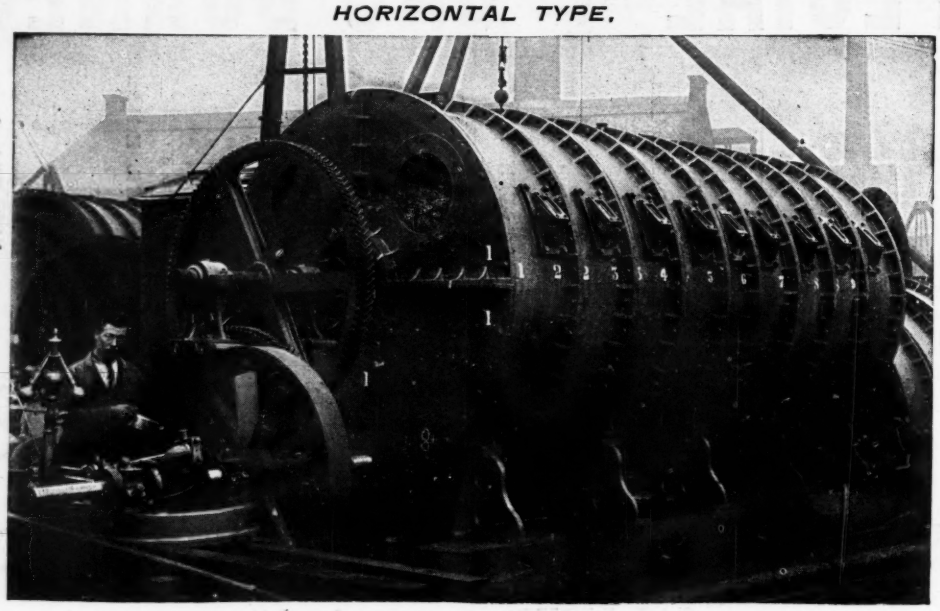

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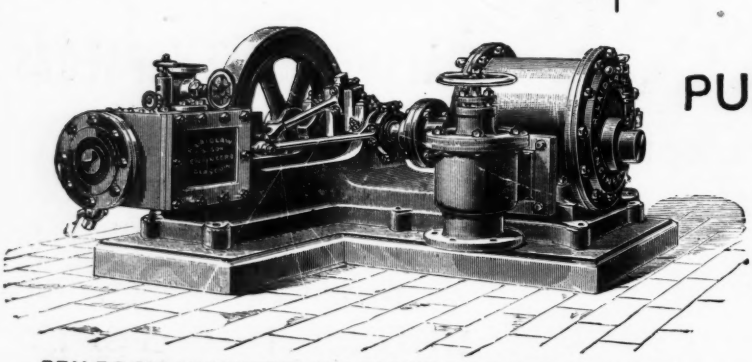

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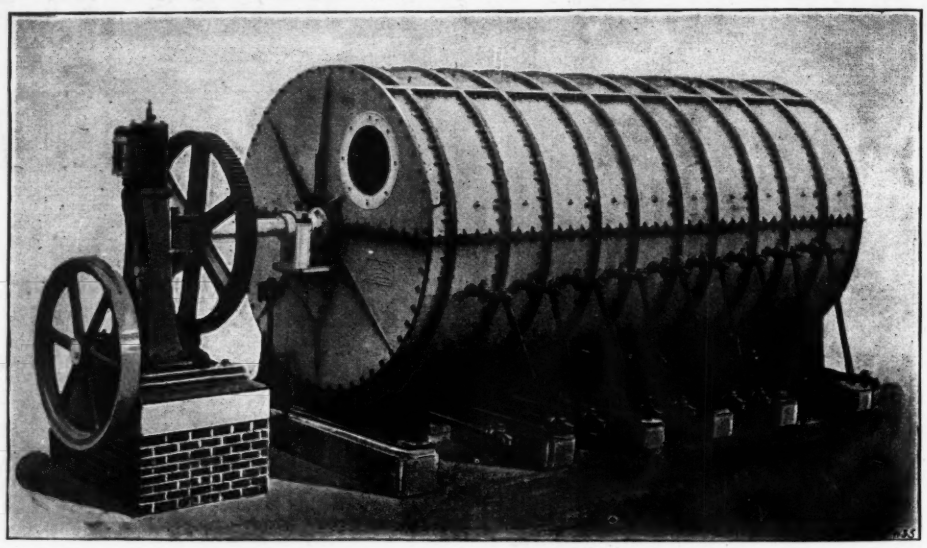

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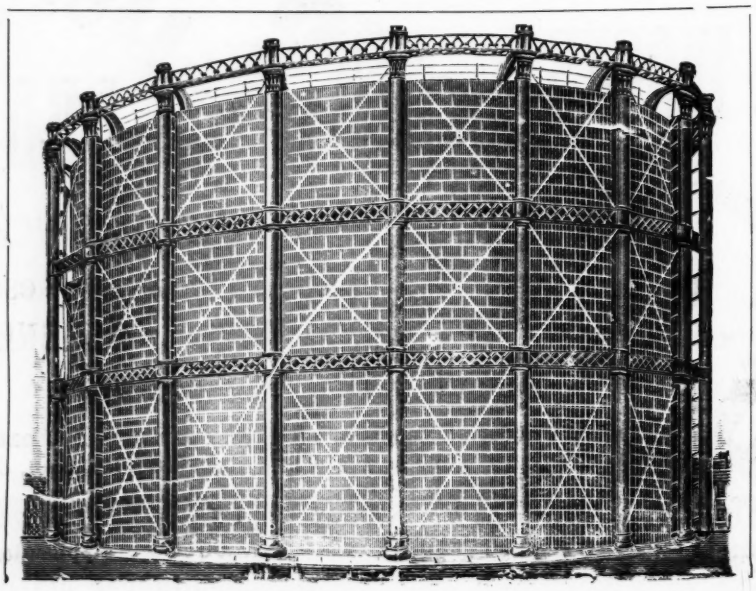

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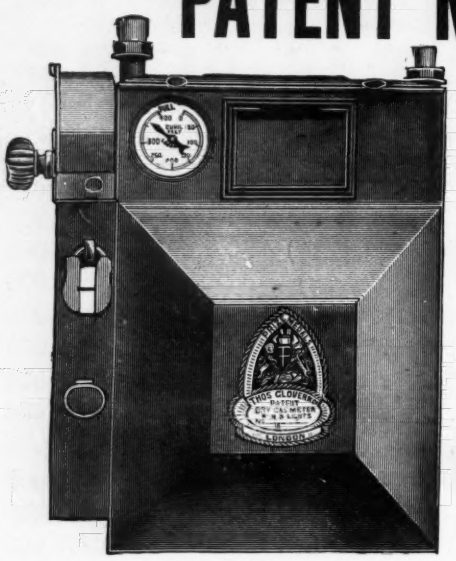

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EDITORIAL NOTES.

The State of the Coal Market.

THE New Year opens with a season of anxiety for many gas managers; the shortage of coal becoming a more serious matter as the days pass. The Christmas Holidays have meant a stoppage of work in the collieries of practically a week; while the holiday passenger traffic has not tended to relieve the congestion of those of the Northern and Midland railway lines upon whose shoulders the coal-owners are freely laying some of the blame of non-delivery. The very rough weather experienced at the end of last week—the barometer on Friday, we note, was lower than at any time since the gale of December, 1886—was also, by the derangement of shipping, calculated to aggravate the troubles of those Companies who depend mainly on seaborne coal for their supplies. Moreover, the past three weeks have been exceptionally favourable to the consumption of gas, and deliveries must have been abnormally heavy in many cases. The result of this concatenation of events has been a considerable depletion of coal stocks, which, owing partly to the failure of contractors to deliver, and partly to the hesitation of some managers to buy fully earlier in the year, in case a reaction in the even then stiff price of coal should arrive, were before none too heavy.

The question of the moment for the Companies who are running perilously short of coal is not what price they shall give for further supplies, but where they are to get such supplies at any price. It is little, if any, exaggeration to say that gas coal is not to be bought "for love or money;" while household coal, to which it is not improbable that many Companies will resort in the not distant future, is becoming more scarce and dearer daily, and prophecies of a real all-round famine in coal are everywhere to be heard. To find a similar condition of the coal market, it is necessary to go back to the period of 1872-4. Coal was then so scarce and dear—that which was 18s. 6d. per ton in 1870 averaged 32s. 6d. for the first six months of 1873; while for two days in February of that year, it was quoted on the Coal Exchange at 45s.—that Parliament appointed a Select Committee early in 1873 to inquire into the causes thereof. The Committee found that one of the principal sources of the scarcity was then, as now, great activity in the iron trade; though it is to be observed that while this activity was then mainly due to an abnormal demand for iron for America, the present increased output is chiefly needed to supply home requirements. A further cause of the shortness of the coal supply in 1873 was found by Mr. Ayrton's Committee to be the unsettled state of the miners, following on the passing of the Mines Regulation Act, and a consequent reduction in the coal raised per miner. It is stated by the owners in some districts at the present time that, owing to the high wages they are receiving, the men are disinclined to work so long as in poorer times. But this state of affairs is, we believe, by no means general. The men in not a few collieries are making hay while the sun shines. That this must be so is evident from the fact that the quantity of coal raised in the year just ended is now estimated at 225 million tons, as against a previous best of just over 202 millions. That the output in the near future will be materially affected by the withdrawal of something like 30,000 miners for service in South Africa is certain, for expert miners are not made in a day, even if raw material out of which to make them were not scarce. But, in spite of this shortage of labour, we see that, in view of the great demand for coal, it is proposed to sink fresh shafts near the coast in Durham, while all the thin-seamed pits, not worth working with coal at low prices, are being mined again.

There can therefore be very little doubt that, even if—as appears probable—the iron trade should continue as active as at present, before many months are over the high prices obtainable for coal will stimulate production until the market can practically supply the demand. This, however, is little consolation to the harassed gas manager, who is facing Generals January and February with very little idea of how he is to win through. If, as we hope, he manages to scrape enough coal together to keep up the supply at proper pressure, he will have some compensation for the cost and anxiety of the pinch, in the value his residuals are fetching. The demand for patent fuel is sending pitch up with a run; and the need of explosives by the Government is considerably hardening the carbolic

market—one of the principal ingredients of lyddite being carbazotic, or picric, acid—while other explosive mixtures are manufactured from gas residuals. Altogether, then, the situation in the next few weeks will be an anxious one for many, and an interesting one for all, of those engaged in the gas industry. It is certainly an uncommon occurrence for managers to be praying to be delivered from a visitation of frost and fog.

Concerning the Gas Residuals Trade.

It is curious to note at how many points the trouble of the Transvaal touches the gas industry—and the gas industry of the United Kingdom at that. Still, although people conversant with the wide developments of gas engineering and the commercial relations of the industry knew that its products went out into all lands, and subserved an infinity of uses, it was distinctly surprising when the Foreign Office last week warned all British manufacturers of, and dealers in, "some of the residual products of gas-works" against selling to new or unknown purchasers, as this might amount to the offence of "trading with the enemy." The reference is obviously to carbolic and cresylic acid, which by nitration becomes picric acid, which in turn constitutes the high explosive for charging shells variously known as lyddite or melinite, according to the characteristics of the last process of preparation for military use. It certainly seems rather late in the day to stop the exportation of British gas-works residuals, for fear of their being returned on our hands in another guise. Besides, as a "Times" correspondent aptly points out, if the enemies of our country want melinite, they can buy it ready made in France. The suggestion is that the English Government should have had the foresight to lay in a sufficient stock of these useful gas residuals some time ago, in which case they might have laughed at the attempts of foreign agents to denude the country of them now. But it is not in accordance with the traditions of the Government of the United Kingdom to be beforehand with anything. If a political party which is "out" elects to take a vote against the party which is "in" on the question of the sufficiency of warlike stores in the country, that is business. At other times, anybody who should warn a Government Department of the gradual disappearance of the raw material of a high explosive and its accumulation in a foreign country, would only get snubbed for his pains. Another gas-works residual which newspaper correspondents newly arrived in South Africa wrote of with suppressed emotion was cyanide. Some of them knew that "cyanide" was something akin to prussic acid; and they jumped to the conclusion that the importation into South Africa of this deadly drug, beloved of the sensational novelist, was intended for the poisoning of the wells. A little higher standard of knowledge of the ways of the scientific and commercial world seems desirable for Foreign Office officials and newspaper writers. So far as dealings in gas-works residuals are concerned, the Foreign Office warning is sadly out of date. Besides, is not coal carbonized everywhere? If all that has been rumoured is true—of train-loads of ammunition passed into the Transvaal at the eleventh hour, and guns sent on the same way under the noses of Colonial officials—it is sheer Departmental pedantry to make out now that there is any harm in the international traffic in gas residuals.

Apart from the political bearing of the possible use of gas-works residuals in the manufacture of munitions of war, it is worthy of remark that public opinion is becoming shaken with regard to the soundness of that German adroitness in the working up of coal-tar drugs and dyes which has been so often thrown in the face of the slow-moving British manufacturer of fine chemicals. We have all heard so many times of those grand German factories where hundreds of chemists are maintained, in dignified independence of commercial results, to witch the world with the fairy tales of synthetical organic chemistry. Well, it seems that the thing is getting overdone. So many wonderful new preparations have been put upon the market from these establishments, that the simple pharmacists and dyers for whom they are made are growing sceptical of the actual existence of differences of constitution and operation among these specialities. The official title of one has a few syllables more than that of its precursor; but what are they among so many? It is not that organic chemistry is exhausted, or that new substances may not come to the front at any moment with characteristics as well marked as that of saccharin, or anything else that might be named as an example. But the suspicion has arisen that the exigencies of his business have put the scientific drug or dye maker in the unenviable position of the spiritualistic "medium"—if the real spirits did not materialize at the right moment, he had to be ready with substitutes, in order not to disappoint his patrons. And, of course, there are people who will say that some of the coal-tar products had better have been left in their native obscurity—such as the "naphthalene yellow," which is suspected of being the means employed to impart a "richness of appearance" to milk and milk products. There is, fortunately, no link between science and ethics, else one might be exercised to pronounce between the comparative morality of utilizing gas-works residuals to make lyddite, or for sophisticating skim milk. One might well be quite as deadly as the other.

Competitive Gas Supply in New York.

Some interesting intelligence has come to hand, in the American technical journals, respecting the course of the "gas-rate war" of New York. Early last month, rumours began to circulate that the suicidal competition between the New York Gas Companies which has prevailed since May last was about to end in the customary fashion by an agreement of the rivals to return to the *status quo ante bellum*. It will be as well to explain what this was. The New York Legislature had cut the Gordian Knot of the metropolitan gas problem, by passing a law that up to the end of last year the price of gas in the city should not exceed $1·10 per 1000 cubic feet; with the New Year it was to be not more than $1·05; and $1 after Jan. 1, 1901. This appears a drastic ordinance, recalling the bread-and-beer assizes of the Middle Ages of English history. The selling price of gas at the time of the passing of the law was $1·50; and the representatives of the Consolidated Gas Company, which is constituted of all the old New York gas undertakings upwards of ten years old or thereabouts, swore by all their gods that the legal rate meant no dividend for their stockholders. The nominal amount of capitalization of the Consolidated Company was $36,000,000; how much of which was "water" nobody could say. It did not seem to matter greatly to the proprietors whether their rate of dividend was 8 or 6 per cent.; and the State Legislature thought it would not hurt them to be restricted to such profit as they could get out of selling gas at the reduced legal price. Thus the Nemesis of arbitrary legislative prescription waited on a long period of secret dealing, during which the associated and ultimately united Companies charged what they would for gas—nobody outside knowing what it could be supplied at on a reasonable commercial and financial basis. The accounts of the Companies are not published, so that the actual amount of their profits was not known. The Legislature brushed aside all financial and technical considerations, and said that New York should have "dollar gas" in the near future.

By the time the new law came into operation, however, other and, as it proved, much more powerful influences had arisen to force down the price of gas in New York. The Consolidated Gas Company had indeed swept up into its big pool all the old Metropolitan Gas Companies; but the weakness of this "Trust" plan of action is that there is no end to the operation. No sooner have A, B, and C combined, and bought up D, than E springs into existence by as good a right as any of the older brood; and it is followed by F and G, and so on *ad infinitum*. "Buy us," says every new comer, "or we will undersell you." Thus the Consolidated Gas Company of New York was exposed to attack by the Standard Company, the New Amsterdam Company, the Mutual Company, and possibly others. We do not know how many concerns were in the business. After some preliminary skirmishing, however, the big Consolidated Company decided, as from last May year, to "freeze out" the younger and weaker Companies outside the ring, and announced their intention to supply gas "until further notice" at the all-round price of 65 cents per 1000 cubic feet. The reason why the Directors took this step, when they might have legally charged $1·10 per 1000 cubic feet, was their cognizance of the fact that the outside Companies were insidiously draining away many of their customers by offering to supply at anything down to 50 or 45 cents. Forthwith, the Mutual Company, which is in harmony with, but not united to, the Consolidated Company, followed suit, and made their rate also 65 cents.

The New Amsterdam Company, who seem to have started the rate-cutting trick, immediately "went one better," with a published price of 50 cents, or anything less that would ensure trade in the competitive area. The Standard Company (another "pirate" concern, in the opinion of the Consolidated people) prudently did not say what their price would be, but only announced their intention of "taking "care of their consumers"—and, doubtless, of as many quondam consumers of the other undertakings as they could get hold of.

So the competition, which it would mightily please certain gentlemen connected with the Corporation of the City of London to see reproduced in this part of the world, raged fiercely during the summer. It was the right season of the year for the combatants to make a great fuss without losing much wool over it; and, of course, the oldest and strongest undertakings felt it least. When the season of large gas consumption had fairly set in, the first of the pirates had to cry off. By the end of November, the New Amsterdam Company were fain to declare that, owing to the vast increase of their business, the capacity of their works was quite overtaken; and they must put up their price to the legal rate of $1·10. The truth of the matter was obvious. Meanwhile, however, the Companies charging 65 cents continued to hold on their way, serenely oblivious of the despairing retreat of their challenger. The administrators of the Standard Company, by the latest advices, did not know what to do. The old Consolidated and the Mutual seem to be quite content to carry on "until further notice," as they originally said, at the 65-cent rate. How long they would continue doing so after their complete triumph over, and the retirement from business of, their rivals—assuming this to be the end of the competition—may be regarded as doubtful. Suppose the State Legislature seizes the opportunity, and nails the rate for New York at 65 cents "until further notice." Why not? If the Companies can do it for their own pleasure, they can do it for the benefit of the public. We have told at length the story of the latest competitive gas supply, because of its intrinsic importance, and also for the sake of its teaching.

The Gloominess of British Streets.

In one of the leading Reviews, a travelled Englishman has recently given publicity to some of his impressions of London on returning to its streets after many years' habitation of Continental cities. In very many respects, these observations apply with equal force to the aspect presented by other English cities and towns which have been largely rebuilt of late years. This witness finds London better lighted than it used to be—artificially, that is. But with regard to natural lighting, he is not so well pleased. He notices with regret the modern tendency to increase the height of town buildings, which, as he truly remarks, is a step in the wrong direction for our northern latitudes. Lofty façades are a mistake where the sun never rises very high in the heavens. Another blunder is the tint and character of the surfaces of our supposed "improved" building frontages. We pour scorn and contempt upon the stucco fronts of old Regent Street, which had to be painted at least once in three years; but the effect was ever so much brighter than that of our modern fashionable terra cotta, pressed brick, or stone, which all weathers in the course of a few years into a dingy, dirty monochrome. He is right. These natural-surfaced building materials are not the most satisfactory for English town buildings. They are almost entirely absorbent of light. Now that we are getting to employ artificial street lights on something like the Continental scale, it is very disappointing to find that they look no better than the lights in a photometer-room, or a coal-cellar, by reason of the blackness of the façades. If white and pale-tinted glazed bricks and tiles are not available for all purposes, let us have the painted plaster again! Architects must be switched off dark red terra-cotta, portland stone, and plain bricks, if anything like cheerfulness is to be preserved for our narrow northern streets.

Two Fatal Gas-Works Explosions.

Two fatal explosions in gas-works happened during the closing days of the Old Year; but the particulars have only transpired in time to be given in our present issue. One was at the town gas-works of Douglas, Isle of Man; the other at the private (oil) gas-works of the Metropolitan District Railway Company, at Lillie Bridge. Both these occurrences were of a simple character, and are chiefly remarkable as illustrations of the force of the old saying, "Familiarity breeds contempt," in regard to the proceedings of workmen engaged in manufacturing operations requiring a modicum of prudence for their safe conduct. In the Douglas case, which unhappily resulted in the death of three men, the circumstances which led to the explosion were explained by Mr. T. Newbigging, the Consulting Engineer to the Gas Company; and our report in another column contains ample information for technical readers as to how it came to pass. The victims of the accident appear to have been working in proximity to a tar and liquor tank by the unprotected light of a candle held by the yard foreman close to the open manhole. The result is not surprising, though we should hesitate to accept the finding of the High Bailiff's Jury as setting out the correct rule of practice in this regard. In the Lillie Bridge case, the man who was killed had a safety lamp for use in looking at his oil and tar tank gauges. Of course, he left it in the cupboard, and struck a match one foggy day when he wanted to see the gauge, which was near both the gas-oil and the oil-tar tanks. Others had done the same thing before; but this time the heaviness and stillness of the atmosphere, or something, made a difference. It is worthy of remark, in view of the flash-point agitation that has been one of the London County Council's hobbies, that the County Council Inspector tested the oil, and found it "had a flash-point of "150°." This grain of fact is bad for the hobby. It, however, supports our contention that all these hydrocarbon fluids are apt to be very treacherous things to handle, and that the most staid of them needs reasonably careful treatment.

The Parliamentary Aspirations of West Ham.

Some of the newspapers have noted with consternation the parliamentary programme of the West Ham Corporation, as notified in the "London Gazette" for Nov. 24, which it fills from p. 7675 to p. 7683. The Bill thus heralded would not, in the ordinary way, come under our notice, inasmuch as circumstances have forbidden to the West Ham Corporation those privileges of gas and water supply which are understood to form the backbone of the Progressivism of many Municipal Corporations. West Ham, however, is well calculated to become the cynosure of Local Authorities of districts in other parts of the kingdom, by reason of its being actually under the domination of some of the lights of Labour and Socialistic politics. Some time ago, these eminent persons cleared their course by sending the old Town Surveyor packing at very short notice. Now they are bent on abolishing their Aldermen, and vesting the powers and property of the Overseers, Burial Board, and Vestry Clerk in the Corporation. The Corporation are to make all the rates, and see about the deduction thereof from the rent. The Corporation are also to have the power of levying all manner of rates and charges, of conferring exemption from the payment of any rates and charges, of erecting artisans' dwellings, and of doing many other things. West Ham not having started as a "Garden City" with wide thoroughfares and imposing vistas, but having, in point of fact, outgrown its mean central nucleus, the latter is to be improved out of knowledge. And then the tramways! There is to be nothing niggardly in the laying out of these necessaries of civilization. It is pleasing to observe that the lack of much that usually goes to make a self-contained municipality, according to modern ideas, is not allowed to cramp the aspirations of the West Ham Progressives. How the borrowing powers of the Authority will bear the strain of all this enterprise, and what the rates are likely to rise to if it is carried out, are matters as to which the Parliamentary Committees to whom the Bill must be referred will probably direct inquiry.

An Anglo-American Engineer.

Some months ago we had occasion to remark upon the peculiarly English and American conception of the nature of the true engineer, as being that of a man who can do certain things as they should be done; and the example we then had in view was the late Mr. Edward Case, of Romney Marsh. Another personal illustration in support of our observations on this head is supplied by the account given in the "Engineering Record" as to the career of

Mr. Arthur J. Moxham, who was lately chosen as Manager of the Dominion Iron and Steel Company, of Montreal, whose works at Sydney, Cape Breton, have a close connection with the coke-gas manufacturing plant at Everett, Boston, already described in the "JOURNAL." Although Mr. Moxham is an Englishman by birth and citizenship, his life's work has lain in America, and its character has been typically American. His record begins in 1870, when he became receiving clerk of a rolling mill in Louisville, which was in financial difficulties. He and some associates leased the works, and ran them successfully for several years. While still a lad—his age was 24—Mr. Moxham organized the Birmingham Rolling Mill Company, who built works at the new town of Birmingham, Alabama, and started business eight months after the plans were settled. A few years later, Mr. T. L. Johnson, a street railway magnate, wanted somebody to undertake the manufacture of what was then an unheard-of thing, but is now universally known as the "girder rail." Other steel-men had refused to undertake to roll such a rail; but Mr. Moxham did it. He and Mr. Johnson went into partnership; and the union soon resulted in the Johnson Company, and the large establishment at Johnstown, Pennsylvania. After a time, the Company thought they were paying too dearly for their steel, and decided to make their own. This was done at Lorain, Ohio, where steel was produced on April 1, 1895, with plant which had been started only in the previous month of July. During Mr. Moxham's reign at Johnstown, the awful catastrophe of the breaking of the dam occurred. In one night, 12,000 people were left without food or shelter, and the sun arose on 3000 corpses. When the survivors first came together, they chose Mr. Moxham for their Dictator. As was told in Congress: "It was he who, in that dreadful "moment, stepped to the front, and, in the name of the "whole community, brought order out of chaos—who "destroyed whiskey and seized food, who fed the living "and buried the dead, and again set in motion the ma-"chinery of organized government and civilized life." Mr. Moxham had retired from business, and started on a tour round the world in his steam yacht. He chanced to meet Mr. Henry M. Whitney, who was responsible for the Cape Breton and Everett scheme, and was persuaded to put off his plans for a long period of leisure and—shall we say?—try and pull this venture round somehow. If this is not a record of a "certificated engineer," it is at least the story of an able man who is as much of an engineer as most members of the profession would like to be.

The World's Coal.—The output of coal throughout the world in 1898 is computed at 662,820,000 tons. In this total, Great Britain figured for 202,054,516 tons; the United States, for 196,405,953 tons; Germany, for 130,928,490 tons; France, for 32,439,786 tons; Belgium, for 22,075,093 tons; Austria and Hungary, for 35,039,417 tons; Russia, for 12,862,033 tons; and all other countries, for 30,960,712 tons.

The Welsbach Company's Patents.—Our readers may remember that in the list given in the "JOURNAL" for the 5th ult. of the firms who had decided to take part in the Gas and Allied Trades Exhibition now being held at the Royal Aquarium, a notice of which appears in another part of this issue, was the Voelker Mantle, Limited, who proposed to place their mantle upon the market early in the New Year. The Welsbach Company assert that this mantle is an infringement of their patent rights; and on this ground they obtained on the 21st ult. an order restraining the Voelker Company, their servants and agents, from such infringement. Copies of this order were duly served upon the employees of the Company and the Manager of the Aquarium; and this will account for the absence of the promised Voelker exhibit. While referring to the Welsbach patents, we may point out that the recent judgment of the Court of Appeal in the Daylight Company's case merely affects the question of costs (the patent referred to having expired when the judgment was delivered), and in no way interferes with the sale of the Welsbach Company's present mantle, which is made under their 1893 patent. This patent, it may be remembered, was strongly supported by Lord Justice Romer, whose views were concurred in by the Master of the Rolls, in the judgment above alluded to. His Lordship characterized the use of a small quantity of cerium in the manufacture of the mantles as "a remarkable and astonishing discovery of later years;" and inasmuch as the patent covering this invention, under which the only mantles that have ever been of any commercial value have been made, has another seven years to run, the statements persistently circulated that the Welsbach monopoly is at an end may be estimated at their real worth. The view of the patent taken by the Court of Appeal is of the utmost importance to the shareholders in the Welsbach Company.

WATER AND SANITARY AFFAIRS.

IN entering upon another year, it may not be out of place to glance for a moment at some of the questions relating to water supply which are likely to occupy attention in the coming twelve months. First in importance, undoubtedly, stands the Metropolitan Water Supply. More than nine months have elapsed since the Royal Commission appointed to deal with the matter held their last public sitting, and no sign has yet been given of the issue of the final report. Just before the inquiry closed, Lord Llandaff, the Chairman of the Commission, seemed to take a rather despondent view of the results of their labours; and he went so far as to hint at the possibility of nothing being done as the outcome of their prolonged investigation. We do not share this view, and venture to express the opinion that the recommendations of the report now daily expected will go far in the direction of placing the water supply of the Metropolis upon a much firmer basis than that on which it now stands. Already the Commission have done some good work by the issue of their interim report, the effect of which has been to ensure an uninterrupted supply of water in those districts of London where it is most needed. This, at any rate, is something accomplished. The questions upon which we are now awaiting the opinion of the Commission are much more difficult than the one that has been disposed of. Is it desirable, in the interests of the ratepayers and consumers, that the supply of water in the Metropolis should be taken out of the hands of the Water Companies, and transferred to one or more public bodies? Should the reply to this question be in the affirmative, we cannot for a moment suppose that it will be on the ground of failure on the part of the Companies to discharge all their statutory obligations, but rather in deference to the growing desire for the municipalization of water-works. But assuming that the reply should be in the negative, the Commission will say what additional powers of control should be exercised by local or other authorities in respect of the water undertakings. The Companies are at present under the supervision of a Department of State; and they willingly submit to it. Evidence of this is afforded by the proposals contained in the Bill, noticed in another column, which they are promoting in furtherance of their scheme of storage reservoirs in the Thames Valley. Such a scheme, carried out on the initiative of the Local Government Board, should furnish all the water required by London for the next forty years; and it would have the special merit of not putting any burden on the ratepayers.

The London County Council have made the second move in their parliamentary plan of campaign, by depositing two Bills to sanction their Welsh water scheme and the purchase of the Water Companies' undertakings; and their progress will necessarily engage a large share of attention, both in the Metropolis and in the Provinces. These two measures will, of course, be opposed by the Companies, but not by them alone. There are already signs of local objections to the scheme; for at the recent annual meeting of the Federated Chambers of Trade for South Wales, objection was raised to the attempt of the London County Council to rob South Wales of that which belongs to her by geographical position and requirements. As a scheme is on foot for providing a water supply for Glamorganshire and Monmouthshire from the watershed upon which the Council have their eyes, its promoters will no doubt seek to make themselves heard against the larger one emanating from the Metropolis. Here comes in the question of the control of watershed areas about which something will in all probability be said in Parliament next session; and allied to it is that of the right to underground water, some alteration of the law in regard to which appears to be called for. The water legislation for the session presents some interesting features which may be left to be dealt with as they arise. Special interest will attach to the Bills for the re-constitution of the Lea Conservancy Board and the formation of Joint Water Boards for Bury and South Essex. In the case of Bury, the parties concerned are pretty well agreed; whereas in that of South Essex it is reported that there are already dissentients among the Local Authorities concerned. The purchase projects will be interesting as showing the progress of Municipalism; while the extension schemes may possibly bring out some new and useful points in connection with boundary and engineering questions. In view of the reverse of last year,

the fate of the East London Water Company's Bill will be watched with a certain amount of curiosity; while that of the Lambeth Company, by which, among other things, an attempt will be made to abolish the sinking fund created under their Acts of 1888 and 1896, may be expected to arouse opposition in the usual quarter.

Reference has already been made to the supervision of the London Water Companies by the Local Government Board. The strictness with which they are looked after by the Official Auditor under the Metropolis Water Act of 1871 (Mr. Allen Stoneham), has been shown in recent annual reports of the Board, as well as by what has transpired at the Companies' meetings. One of the latest difficulties has arisen with the Chelsea Company, whose accounts for the past and the preceding half year had to be presented to the proprietors without the signature of Mr. Stoneham. The trouble arose over a sum of £34,215, under the following circumstances: The Company paid off two sums of £80,000 and £90,000 which they had raised by bond prior to, or under the provisions of, their Act of 1852, and re-borrowed £135,785 by perpetual 4½ per cent. debenture stock; raising the balance of £34,215 by the creation and issue of ordinary shares, which have since been converted into stock. In the March accounts, the last-named sum was thus entered. But, on making his usual investigation, the Official Auditor would not certify them, on the ground that the mode in which this amount had been raised was not authorized by the Acts relating to the Company. This little "rift "within the lute," as the Chairman called it at the recent half-yearly meeting of the Company, postponed the payment of future dividends, in accordance with section 40 of the Act of 1871. The Directors felt that they had acted rightly in what they had done, having consulted Mr. Cripps and Mr. Cozens-Hardy on the matter; but, in order to remove the difficulty, they promoted a Bill to sanction the conversion of the shares in question into stock and the payment of the dividends, notwithstanding the absence of Mr. Stoneham's signature to the accounts. Happily, however, there is a possibility of the dispute being satisfactorily arranged; and, consequently, the Bill will be dropped. All's well that ends well. At the same time, expense has been incurred in drafting the Bill and giving the necessary notices, all of which might have been saved if the Directors had been informed a little more promptly as to the intentions of the Official Auditor.

Trade Disputes in 1898.—The report of the Chief Labour Correspondent of the Board of Trade (Mr. H. Llewellyn Smith) on the strikes and lock-outs in 1898 was issued last Thursday. It shows that the number of disputes was 711, or considerably less than in any of the previous four years. The number of workpeople affected numbered 253,907; while the aggregate duration of working days lost was 15,289,478. This large aggregate, it is explained, is due to the fact that one important dispute of the year—that in the Welsh coal trade—not only involved a great number of persons, but lasted for an exceptionally long period. As to the results of the various disputes, the balance of advantage was largely on the side of the employers—due again to the Welsh coal trade dispute, which resulted unfavourably for the workpeople concerned. We purpose noticing this report at greater length.

The Coal Trade Outlook in Great Britain.—Dealing with the subject in a recent issue, the "Iron and Coal Trades Review" remarked that if the figures given by the Royal Commission of 1869 as to the quantity of coal then lying at depths not exceeding 4000 feet in the coalfields of the United Kingdom—viz., 90,208 tons—were approximately correct, though they have since been proved to have been under-estimated, it should not be a difficult matter to compute, from our rate of increase in production since the figures were compiled, the approximate date when our coal should be expected to become scarce and dear. Mr. Price-Williams, in a paper read before the Royal Statistical Society, arrived at the conclusion that, granting an average increase of 2½ per cent. per annum, the total output between 1897 and 1988 would be 72,077 million tons, which would practically, with the quantities worked between 1869 and 1897, mean the approximate exhaustion of our ascertained coal supplies towards the close of the next century. This estimate was founded on the assumption that we shall go on increasing the annual output as we have hitherto done until, in the ten years ending 1987, it reaches 1723 million tons, which would mean eight tithes the approximate output of coal for this year. Our contemporary thinks it extremely unlikely that any such annual output will ever be reached, and considers that if the average annual production remains what it is, and has been for the last few years, the result shown by the adoption of these figures will, of course, be very different, and our available supplies should be quite equal to keep us going for several centuries to come.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 41.)

THE condition of the Stock Exchange last week—the closing week of the year—was a surprise to most people. Bad as its predecessor had been, almost worse was anticipated to follow. Money is always tight at the end of the year; and the stringency was already so acute that it would scarcely bear drawing any closer. To the universal relief, therefore, came a slackening of the pinch. The Stock Exchange settlement, which had been an object of dread, was got through better than might have been hoped, although some smaller operators had to succumb. Its demands for money were fairly well met; and generally there was a more cheerful feeling abroad. Prices in every department advanced, some of them showing considerable gains. Discount rates have eased off materially; and if the relaxation be not overdone, they may well remain so awhile. In the Gas Market, business was decidedly limited; and there was very little movement in prices. What there was, too, was very irregular; the various issues affected appearing to be influenced by the special circumstances of their case. In Gaslights, the ordinary was moderately dealt in at good, steady figures, which varied but little through the week; but the quotation was pushed by small stages. The secured issues presented no feature. South Metropolitan was rather quiet, and quite firm. Commercials were untouched. Scarcely anything was marked in the Suburban and Provincial group; and quotations stood still. The Continental Companies were almost equally listless; but Imperial receded a point. There was nothing observable among the remoter undertakings, beyond a slight retrogression in Buenos Ayres and River Plate. Business in the Water Companies was much restricted; and prices continued to show a marked disposition to shrink.

The daily operations of the four days available for business need not be detailed.

A comparative table of the prices of Gas and Water Stocks as they are now, and as they were twelve months ago is appended. The fact that, for the most part, quotations are lower now than they were then can only have been expected when the present large rise in the value of money is considered. Some reductions proceed from local troubles and impaired dividends; and some improvements are traceable to increased prosperity and appreciation of the undertaking. Gaslight and Coke and Tottenham and Edmonton issues have been reconstructed in the course of the year, and do not permit tabular comparison with the figures of a year ago.

NAME. GAS COMPANIES.	Prices on Dec. 31, 1898.	Prices on Dec. 30, 1899.	Gain or Loss.
Alliance and Dublin Company, 10 per cent.	21—22	21—22	—
Do. 7 per cent.	16—17	14¾—15¼	−1¼
Australian (Sydney) 5 per cent. Debentures	105—107	102—104	−3
Bombay, Limited	6¼—6¾	5¾—6¼	−½
Do. New, £4 paid	4¼—4¾	4—4½	−¼
Brentford, Consolidated	275—280	273—278	−2
Do. New	210—215	210—215	—
Do. 5 per cent. Preference	140—145	140—145	—
Do. 4 per cent. Debenture Stock	128—133	124—128	−4½
Brighton and Hove, Original	263—268	250—260	−10½
Do. A Ordinary Stock	192—196	183—188	−8½
Bristol, 5 per cent. max.	130—135	130—135	—
British	45—47	43¾—44¾	−2
Bromley, Ordinary 10 per cent.	26—28	25—27	−1
Do. 7 per cent.	20—22	19—21	−1
Buenos Ayres (New), Limited	9½—10	8½—9	−1
Do. 4 per cent. Debenture	98—100	98—100	—
Cagliari, Limited	29—30	28—29	−1
Cape Town and District, Limited	14—15	13½—14½	−½
Do. 6 per cent. 1st Mort.	57—59	56—58	−1
Commercial, Old Stock	310—315	305—310	−5
Do. New do.	240—245	240—245	—
Do. 4½ per cent. Debenture Stock	145—150	140—145	−5
Continental Union, Limited	200—205	177—181	−23½
Do. 7 per cent. Preference	187—192	178—183	−9
Croydon Commercial, A 10 per cent.	315—320	335—340	+20
Do. B 7 per cent.	252—257	265—270	+13
Crystal Palace Ordinary 5 per cent. Stock	125—130	130—135	+5
Do. 5 per cent. Preference	140—145	140—145	—
European, Limited	23—24	21—22	−2
Do. £7 10s. paid	17—18	15½—16½	−1½
Gaslight and Coke, 4 per cent. Ordinary	—	104—106	—
Do. 3½ per cent. maximum	—	97—99	—
Do. 4 per cent. Con. Pref.	—	119—122	—
Do. 3 per cent. Con. Deb.	—	96—98	—
Hong Kong and China, Limited	13½—14½	13⅝—14⅝	—
Imperial Continental	227—232	212—217	−15
Do. 3½ per cent. Debs. Stk.	102—105	101—104	−1
Malta and Mediterranean, Limited	4¾—5¼	5—5½	+¼
Metropolitan of Melbourne 5 p. c. Deb.	110—112	110—114	+1
Do. Do. 4½ p. c. Deb.	105—107	107—109	+2
Monte Video, Limited	13—14	11—12	−2
Newcastle and Gateshead Consolidated	232—236	220—225	−11½
Do. 3½ p.c. Deb. Stk.	112—115	104—107	−8
Oriental, Limited	7—7½	7—7½	—
Do. New, £4 10s. paid	6¼—6½	6¼—6⅝	—
Do. do. 1879, £1 paid	1¼—1⅝	1¼—1⅝	—
Ottoman, Limited	5—5⅛	5¼—5⅜	+⅛
People's Gas of Chicago, 2nd Mtg. Bds.	102—105	102—106	+⅛
River Plate, Ordinary	9—9⅛	10¼—11	+1⅛
Do. 4 per cent. Deb. Stock	98—100	98—100	—
San Paulo, Limited	15—16	12—13	−3
Sheffield, A	242—245	247—249	+4½
Do. B	242—245	247—249	+4½
Do. C	242—245	247—249	+4½

Name.	Prices on Dec. 31, 1898.	Prices on Dec. 30, 1899.	Gain or Loss.
GAS COMPANIES.			
South Metropolitan, 4 per cent., Ordinary	136—139	133—136	—3
Do. 3 per cent., Deb. Stk.	102—105	101—103	—1½
Tottenham and Edmonton, A	—	141—143	—
Do. B	—	102—104	—
Do Deb.	—	113—117	—
Tuscan, Limited	9½—10½	9—10	—½
Do. 5 per cent. Debs. Red.	100—103	98—100	—2½
WATER COMPANIES.			
Chelsea, Ordinary	310—315	305—310	—5
Do. 5 per cent. Preference	168—173	157—162	—11
Do. 4½ per cent. Preference Stock 1875	147—150	140—145	—6
Do. 4½ per cent. Debenture Stock	157—162	148—153	—9
East London, Ordinary	210—215	200—205	—10
Do. 4½ per cent. Debenture Stock	157—160	145—150	—11
Do. 3 per cent. Debenture Stock.	101—103	98—100	—3
Grand Junction 10 per cent. maximum	110—115	107—109	—3½
Do. 4 per cent. Debenture Stock	138—143	131—136	—7
Kent	365—370	348—353	—17
Do. New, 7 per cent. maximum	212—217	200—210	—9½
Lambeth 10 per cent. maximum	295—300	290—295	—5
Do. 7½ per cent. maximum	225—230	215—220	—10
Do. 4 per cent. Debenture Stock	138—143	135—138	—4
New River, New Shares	432—437	428—433	—4
Do. 4 per cent. Debenture Stock	138—143	133—138	—5
Southwark and Vauxhall, Ordinary	184—189	203—208	+19
Do. Do. 7½ per cent. do.	170—175	190—195	+20
Do. Do. 5 per cent. Pref.	168—171	160—165	—7
Do. Do. 4 p. c. A Deb. Stk.	138—143	131—136	—7
West Middlesex	290—295	290—295	—
Do. 4½ per cent. Deb. Stock	160—163	147—152	—12
Do. 3 per cent. Deb. Stock	102—105	100—102	—2½

ELECTRIC LIGHTING MEMORANDA.

The Popularity of Electric Lighting Imperilled—The Cost of High Voltage Lighting—Information Wanted—Mr. R. Hammond on the Needs of Dublin.

Recent events in electric lighting "circles" in different parts of the country are considerably exercising the technical mind, and not a little troubling that section of the public which patronizes central station electricity supplies. The shortcomings of so many undertakings when the dark days of winter set in were a great annoyance and disappointment to many influential supporters of the fashionable illuminant; and the defaulting electricians learnt with chagrin that their excuses, which ranged all the way from the engineers' strike to the Transvaal war, were not accepted. People who were left in darkness when they wanted light proved unappeasable by mere words. On the top of these sporadic shortages, came a sudden extinction of the light over another district which had rejoiced in a constant and uninterrupted supply for nearly ten years. This occurrence, as an electrical contemporary confesses, was due to "one of those rare accidents likely to shake the public faith in the reliability of electric supply." Then came the moving incident of the outbreak of fire at Mr. Montague Crackanthorpe's, described in our last week's Electric Lighting Notes (p. 1558); and this was swiftly followed by the deplorable transformer fatality at Bolton. In view of these troubles it is no wonder the "Electrician" regards the popularity of electric lighting as seriously imperilled.

It is impressed on the whole electrical profession by our contemporary that no off-hand treatment of the emergency on the "accidents will happen" line is likely to reassure the public, and restore the shaken confidence of the community in the ability of electricity supply undertakers to fulfil their obligations. The matter is no mere grumbling, as of one customer who feels that he is not so well served as his neighbour next door, or in the district of another company. What the general public are coming to perceive is that all services of the kind are no better or safer than they were a decade and more ago. It is the same old original sins that persist in the grown-up organism which was so severely dry-nursed by the Electric Lighting Act in 1882. The public want a reliable, adequate light at reasonable cost; and they do not want mysterious conflagrations and death-dealing shocks. It is doubtful if many electricians yet realize how much heed the users of electric light pay to these elementary points, and how utterly beside the main point are all the technical frills and feathers which fill the professional papers and periodicals and pass for "progress." What is a saving of fuel appearing in the second place of decimals in the analysis of working costs per unit—what is anything else, to a man who cannot get a light when and where he wants it?

It is unfortunate that just at this juncture many electricity supply undertakings are trying to change their distribution voltage from 100 to 200. People in some of the London electric lighting areas are complaining that their local companies are trying to "coerce" them into consenting to the change by threatening to cut off the supply in the event of refusal, or by raising the price of current to the statutory maximum, and so forth. Of course, electric lighting undertakers have no power to act in any such manner; and it therefore seems foolish to threaten to do so. It appears, however, that the consumer is more often asked to consent to the alteration by the inducement of a discount off the customary charge for current—8 per cent. is named as an offer. Against this advantage, it is alleged that the higher voltage means an increased consumption of current per lamp, and more lamp renewals. The difference is put as high as 25 per cent. to the consumers' light bills on the whole. It would be a satisfaction if some competent and reliable witness would tell the world the truth about this matter. Honestly, we do not know the exact rights of it.

Electricians are very much "on the rampage" in some of the most prominent cities and towns of the kingdom outside the Metropolis. Already, the electric lighting troubles of Dublin are notorious. The Corporation have had several advisers of various degrees of competence and impartiality; and now they have gone back to Mr. Robert Hammond, who has fallen in with the old suggestion, condemned years ago by Dr. Kennedy, to shift the generating station to Pigeon House Fort. Those who are locally interested in the business will doubtless find it edifying to compare Kennedy of 1897 with Hammond of 1899. It is sufficient for us to remark here that the Sub-Committee of the Electric Lighting Committee of the Corporation have just recommended the adoption of Mr. Hammond's scheme, the most notable feature of which appears to be that while the generating plant is to be capable of supplying 63,300 lamps of 8-candle power, there are to be 95,000 lamps returning revenue. It is not for us to say where all these lamps are to be fixed. Mr. Hammond has been over the place, and we have not. He is a sanguine gentleman; as appears from his recommendation to lay out new electricity distributing plant all over Dublin, "in many cases in most unpromising positions . . . . in view of the certainty of the time arriving when gas as an illuminant will disappear from Dublin." There is nothing like taking time by the forelock; but in no pictorial realization of the Man with the Scythe have we seen him portrayed with a tuft of such length as would be that after which Mr. Hammond is fondly feeling. Who was the philosopher who used to recommend "patience and short views" as a good rule of sane and contented living? He seems to be badly wanted in Dublin.

GAS BILLS FOR 1900.

The Bills for the coming session of Parliament relating to gas supply which have been deposited in the Private Bill Office are as follows, beginning with those promoted by Gas Companies:

The Bedford Gas Bill is to enable the Company to raise £40,000 additional share capital, which may be issued as 7 per cent. ordinary or 4 per cent. preference capital. The borrowing powers are to extend to one-third of the new issue.

The British Gaslight and Coke Company, Limited (Staffordshire Potteries), Bill is to authorize the Company to expend for the purposes of the undertaking capital to the amount of £75,000, in addition to the sum of £197,610 already authorized by previous Acts down to 1895. Of the new capital, not more than £50,000 is to be in capital stock of the Company bearing 5 per cent. interest, and the balance is to be borrowed money bearing not more than 4 per cent. interest. All loans to be raised under the Act are to be procured on the best terms obtainable at the time of borrowing. Additional gas lands are to be acquired in Hanley, for the construction of extension works.

The Cleethorpes Gas Bill proposes to convert and consolidate the old capital of the Company into the equivalent sum of 5 per cent. stock, and to increase the amount by £60,000, with power to borrow one-third. The sliding-scale imposed on the Company by an Order of 1879 is to be adjusted. The initial price is 4s. per 1000 cubic feet; and the sliding-scale is to operate in respect of entire years. Additional gas lands are required. The Company propose to take powers for manufacturing and dealing in everything "in any way connected with gas-works or with the supply of gas, as they may from time to time think fit." A certain occupation road is to be stopped up. The insurance fund is to be made applicable to the compensation of workmen. Power is sought for the laying of pipes in undedicated roads, and to use pipes for ancillary purposes. The rate of interest payable on consumers' deposits is to be reduced to 4 per cent. The use of anti-fluctuators may be required for gas-engine services; and the customary clauses are inserted in relation to prepayment in certain cases, the period of error in defective meters, and the exemption of hired-out fittings from distress.

The Gaslight and Coke Company's Bill is to authorize the creation and issue of debenture stock not exceeding the nominal amount of £2,500,000. This new issue would be known as the Second Three per Cent. Debenture Stock, and rank next after the existing Three per Cent. Consolidated Debenture Stock. The amount is one million sterling less than the Company asked for in their last year's Bill. The holding of the Company in certain scheduled lands and hereditaments is to be confirmed; and the Company propose to acquire by agreement other 150 acres of land, not for manufacturing gas or any residual product.

The Glastonbury and Street Gas Bill is to incorporate and confer powers on a Company originally formed in 1862, who obtained an Order in 1892. The present share capital consists of £4575 in original 10 per cent. shares, and £5425 in 7 per cent. shares, with £2200 borrowed money. The Company's limits of supply are to be enlarged to include the parish of Walton, in the rural district of Wells; and the name of the Company is to be changed to the Glastonbury, Street, and District Gas Company. The existing ordinary share capital is to be consolidated and converted into an equivalent amount of 5 per cent. stock, to which £20,000 of new capital is to be added. The loan capital is to be in the proportion of one-fourth. The sliding-scale clause of the Order of 1892 is to be applied to the converted stock. Power is sought for the declaration of an interim half-yearly dividend without the calling of a meeting of shareholders. The Company desire to acquire not exceeding

6 acres of additional land by agreement, not for manufacturing purposes.

The Grantham Gas Bill is to enable the Company to extend their supply to the parishes of Great Gonerby and Barrowby, in the parts of Kesteven, Lincolnshire, and to extend their works. The existing share capital of the Company is to be consolidated into the equivalent amount of 5 per cent. stock, with the addition of £45,000 of new stock. The borrowing powers are to be one-third of the amount of the consolidated stock. Gas of 15-candle power is to be supplied. The rate of interest on consumers' deposits is to be reduced to 4 per cent. Power of inspection of new consumers' fittings is sought, subject to appeal to two Justices from the Company's order to amend.

The Hartlepool Gas and Water Bill is also a stock conversion and consolidation measure. The existing share capital, amounting to £390,000, is to be, "by force of this Act only, and without any other requisite, consolidated and converted into £573,000" Hartlepool Gas and Water Company's five per cent. maximum ordinary stock. The Company desire an addition of £200,000 to their gas capital, at 5 per cent. maximum dividend, with power to borrow one-fourth.

The Kingston-upon-Thames Gas Bill is for general extension purposes. The existing share capital of the Company is to be consolidated and converted into £192,500 of standard 5 per cent. stock, with the addition of £107,500 of new stock. The borrowing powers are to be increased to one-third of all nominal stock issues. Additional gas lands are required. It is proposed to adopt the sliding-scale, with the standard price of 3s. 6d. per 1000 cubic feet. Gas for the public lamps is to be charged at the lowest prevailing price. Pipes for ancillary purposes are to be laid with consent of the Local Authority. Fifteen-candle gas is to be supplied, under detailed prescriptions as to testing. Power is sought to supply gas in bulk, and also to apply for an Electric Lighting Order, but not for the borough.

The Maidenhead Gas Bill is to consolidate and convert the existing share capital into a stock bearing a maximum 5 per cent. dividend, with the addition of £60,000 of new capital, and one-fourth borrowing powers. It is proposed to take the sliding-scale, with the standard price of 4s. per 1000 cubic feet within 1¼ miles of the Maidenhead Town Hall, and 4s. 3d. beyond. Gas of 15-candle power is to be supplied, tested on the works.

The Newport (Mon.) Gas Bill is to extend the limits of supply and consolidate the existing capital upon a 5 per cent. basis. Additional capital to the amount of £150,000 is required, with one-fourth loan. A clause provides for the settlement by arbitration of disputes as to the crossing of railways or canals by gas-mains.

The Ossett Gas Bill is to extend the limits of supply and other statutory powers of the Company. The existing share capital is to be consolidated and converted into £69,200 of 5 per cent. stock, with the addition of £50,000 of new capital, and one-fourth loan. The sliding-scale is asked for, with a standard price of 3s. 6d. per 1000 cubic feet for 15-candle gas. A copy of the Bristol clause of last year respecting the control over consumers' fittings is proposed. Power is sought for the provision of workmen's dwellings.

The Redhill Gas Bill is to enable the Company to enlarge their works, and to raise £75,000 additional 5 per cent. capital, with power to borrow one-third. The sliding-scale is proposed, with the standard price of 3s. 6d. per 1000 cubic feet within the borough of Reigate, and 4s. beyond, for 15-candle gas. The existing share capital may be consolidated and converted into a 5 per cent. stock, with the sanction of three-fourths of the proprietors in special general meeting. Demands under £50 are to be made recoverable in the County Court.

The Rugeley Gas Bill is to incorporate a limited Company formed in 1847, and never placed under statutory protection. There is a share capital of £10,000, fully paid up; and £4000 has been expended out of revenue on works extension and improvement. The capital of the new Company is put at £30,000, whereof £20,000 is to represent the original share capital, £4000 is the improvement capital, and £6000 the new capital to be raised—all bearing 5 per cent. standard dividends. A clause is proposed enabling the Directors to take out of, and charge to, revenue account a "renewal fund" payment of 1½ per cent. on the paid-up capital; the maximum amount of such fund being 5 per cent. on the said paid-up capital. This fund is to be applicable to the "renewal and repair" of the gas-works, mains, and pipes. The sliding-scale is asked for, with the standard price of 4s. 6d. per 1000 cubic feet for 15-candle gas. Clause 63 proposes that: "All fittings connected with any service gas-pipe to communicate with the mains and pipes of the Company which shall be provided by any person, shall be placed and removed under the superintendence of the Company, and at the expense of such person." Discounts up to 20 per cent. may be allowed to consumers. The Company desire to be empowered to apply for an Electric Lighting Order

The South Metropolitan Gas Bill has already been summarized in the "JOURNAL" (*see* Vol. LXXIV., pp. 1483, 1496). It is to empower the Company to vary the standard price of their gas from 3s. 3d. to 3s. 1d. per 1000 cubic feet, according as the illuminating power is dropped from 16 to 14 candles. The statutory price is at present 3s. 6d. per 1000 cubic feet for 16-candle gas. New provisions are to be made for the testing of the gas; and the surcharge to users of slot meters to cover the cost of the fittings is not to exceed 9d. per 1000 cubic feet. Provisions are suggested for the regulation of this class of business and its representation in the official accounts of the undertaking. Power is sought for the making of a railway to connect the East Greenwich station of the Company with the Angerstein branch of the South-Eastern Railway Company. A part of the Bill relates to the authorization of the purchase by the Company, by agreement, of the Surrey-side portion of the undertaking of the Gaslight and Coke Company. Another part deals with the form of accounts of the Company, and proposes to show the difference due to stock conversion.

The Wandsworth and Putney Gas Bill is to enable the Company to enlarge their works; taking fresh lands for the purpose and stopping up certain thoroughfares. The existing capital is to be consolidated and converted into "A" consolidated 5 per cent. stock, "B" consolidated 3½ per cent. stock, and 3 per cent. debenture stock. The Company require £300,000 of new 3½ per cent. stock, with one-third in debenture stock. The Company's standard price, settled in 1880, is not to be altered; but the sliding-scale is to be adjusted to the new denominations of capital. Pipes may be used for ancillary purposes. A clause extends the exemption of the Company from the London Building Acts, to structures hereafter to be erected.

The Wolverhampton Gas Bill is to permit the Company to enlarge their works, erect workmen's dwellings, and raise £140,000 of additional 6 per cent. capital, with one-fourth loan. The usual clause requiring consumers to give 24 hours' written notice of their intention to quit premises supplied with gas is slightly varied, to make the consumer liable to pay all dues until 24 hours after he shall have given notice that he has quitted the premises. This liability ceases at the next usual registration, or on reletting. The Bristol clause as to the position of meters, &c., is inserted. Demands under £50 are to be recoverable through the County Court. Penalties are not to be incurred for unavoidable or insignificant defaults in the supply. The power of sale to the Corporation of Wolverhampton included in the Company's Act of 1852 is to be re-enacted.

IRON AND STEEL IN 1899.

REFERENCE was made in the "JOURNAL" last week to some statistics published by the Board of Trade bearing upon the rise in wages and prices in the iron and steel trades. We have now received the "Trade Review" published at the close of each year by Messrs. Bolling and Lowe, which has a higher value than the official statistics by reason of being, in addition to a compilation of figures, a survey of the past year's working and the present situation written by first-hand observers in the metal industries, well acquainted with the commercial world in general.

Messrs. Bolling and Lowe naturally refer with much satisfaction to the present state of the market, and to the greatly increased volume and value of their trade in the past twelve months. Their comparison of prices, comprising those of Middlesbrough pig warrants, Scotch warrants, and hematite warrants, bar iron, steel rails, angles, plates, &c., on the 14th of December with the corresponding prices in the two preceding years, shows an average increase of 35 per cent. over 1898, and 52 per cent. over 1897 figures. Satisfaction at the present state of affairs does not, however, prevent the writers from recognizing that, while they have great hopes that the activity in their trade will last for a considerable time, the existing period of prosperity cannot be permanent or even of very prolonged duration. It can, in fact, only last while Germany and the United States continue to be so largely occupied with supplying home requirements. When these requirements fall off, or when stimulated production overtakes the market, and the time comes for these countries—especially the States—to seek outlets for their surplus production, a rapid fall in prices, both here and on the Continent, will inevitably ensue. That such reaction need not, as we said last week, be immediately anticipated is, however, evident from the fact that, while the output of rails in the States for the past year is estimated at 2½ million tons (chiefly for use in the construction of new, and the relaying of old, lines in that country), it is reported that home orders to the extent of 2 million tons of rails for the ensuing year have already been booked.

The extension of the railways in the United States has indeed been most remarkable; the mileage having exactly doubled in eighteen years. The absolute figures are 186,810 miles of railway in 1898, compared with 93,262 miles in 1880; an increase valued by Messrs. Bolling and Lowe at 1029 millions sterling. The consequent growth of the iron trade in the United States, and her rapid overhauling and passing of our own country in this respect, will be best realized from the following comparison. (The 1870 and 1895 figures are taken from the Board of Trade returns, the 1899 from Messrs. Bolling and Lowe's review.) The production of pig iron in those years was—

	1870 Tons.	1895 Tons.	1899 (estimated) Tons.
United Kingdom . . .	5,963,515	7,703,459	9,000,000
United States	1,665,178	9,446,308	14,000,000

It is, then, obvious what a very serious matter it will be for the iron industries of this country when our friend across the herring pond finds his home requirements much more than satisfied by his production. To those who are, from mere curiosity or more

directly, interested in the relative positions of English and American trade, may be recommended a study of a symposium in the "North American Review" for October, on "The Anglo-Saxon Rivals," and particularly of Mr. Maurice Low's article on "The Decline of British Commerce."

In referring to commercial conditions in the States, Messrs. Bolling and Lowe incidentally make an observation which, when read, appears obvious, but is, in fact, frequently overlooked by those responsible for vast undertakings. The remark is *à propos* to the statement that the gigantic Trusts in America have yet to prove their value to the shareholders and the country, and is to the effect that "to direct concerns working with vast capitals hitherto unheard of in the industrial world, and in some cases under totally new conditions, must require master minds." Who that is intimately acquainted with the inner history of the large amalgamations in the gas world, will, arguing *de minima ad maxima*, fail to appreciate the truth of this observation? The human factor is the determining one; and the greater the undertaking, the greater the power of that factor to make or mar.

On the situation generally Messrs. Bolling and Lowe express the opinion that a high Bank Rate and scarcity of gold will rule for some time to come. Industrial concerns and traders must, under pressure of higher values of materials, be prepared in many cases to find much more working capital than formerly sufficed, and at an increased cost as compared with last year. This, as we have formerly pointed out, is a very good reason for avoiding any but absolutely necessary capital expenditure. We do not believe, as a general principle, in "starving" works; but there are times, of which the present is one, when it is at least advisable to keep them hungry. As to the effect of the Transvaal war on trade, it is pointed out and the fact illustrated that after war both victor and vanquished usually show greater activity in all directions than they did in the preceding time of peace; and the conclusion is drawn that, once the Transvaal troubles are settled, great development will take place all over South Africa. The iron and steel trades, it is clear, can enter upon the New Year without serious misgiving for the near future.

GAS SUPPLY IN GERMANY—THE CREFELD WORKS.

THE Continental excursion of the Incorporated Institution of Gas Engineers last autumn brought home forcibly to the minds of many who took part in it the conviction that there was much of value to be learnt from a study of the plant and operations of a modern German gas-works. It is true that the "JOURNAL" had kept its readers posted in the contemporary history of gas supply in Germany, and had pointed emphatically to the great strides which had been made there of recent years in gas manufacture, simultaneously with the immense expansion of general industrial effort throughout that country. But to many conviction arrives only with ocular evidence of the truth of even well authenticated statements; and the autumn excursion of the Institution proved an invaluable eye-opener to some who were fain to believe that British gas-works embodied all that was of value in gas manufacture.

It is not many years since Germany had much to learn from, and nothing to teach, us in connection with the gas industry; but she has latterly advanced to a foremost position in this, as in many other important industries. How rapid has been her advance in the iron industry, for instance, is shown by figures published in the "Zeitschrift für angewandte Chemie." In 1877, she produced only 1900 tons of pig iron, against 6600 tons on the part of Great Britain. In ten years her production had more than doubled; for in 1887 it was 3960 tons, compared with Great Britain's 7560 tons. By 1897, the German output was 6770 tons, and the British 8795 tons. Thus in twenty years Germany succeeded in increasing her production of pig iron to three-and-a-half times its former amount; while the British output increased only by one-third. This is an indication of the progress which Germany is making in an industry which was not long since all but a British monopoly. It is true that simultaneously the United States, with unrivalled natural advantages, had made somewhat faster progress in the iron industry—having advanced from an output of 2065 tons in 1877 to the record output of 9650 tons in 1897—but comparing the resources of the two countries, we are forced to the conclusion that the German progress is the more meritorious. In the gas industry, we do not find so clearly marked an advance in Germany; but the conditions obviously are dissimilar, as the area of supply is of necessity restricted in the case of each gas-works. There is no import and export of illuminating gas; each country and each town must be its own producer. Making due allowance for this limitation of the development of gas-works, we must admit that, relatively to other countries, Germany has made as much progress in the gas industry during the last quarter of a century as she has done in the iron industry. We do not propose now furnishing exhaustive evidence of the correctness of this proposition, which we believe few readers will attempt to gainsay, but will merely draw attention to the progress the last few years have witnessed in one German gas-works, of which a most exhaustive annual report has just come to hand.

The works referred to is that of Crefeld, a town of about 108,000 inhabitants in the Rhine Provinces of Prussia. It is the seat of the silk and velvet manufacture of Germany, and in other respects is an important industrial centre. Since 1871, its population has nearly doubled. The gas supply is now in the hands of the Municipality, who acquired it in July, 1896. There were then two works, of which one was capable of producing 106 millions, and the other 141 millions per annum. Since then the second of these two works has been greatly enlarged; and further extensions are in progress. The total make of gas during the year ending March 31 last was 301,975,000 cubic feet, of which 231,735,000 cubic feet was made at the second works, which are in the St. Töniserstrasse. The increase over the total make of the preceding year was 12·22 per cent. The unaccounted-for gas, however, reached the large proportion of 11·88 per cent. of the make; and therefore the gas sold was only 266,100,000 cubic feet. Of this, 57·25 per cent. only was for illuminating purposes—viz., 8·36 per cent. for public lighting, 5·69 per cent. for lighting public buildings, 41·42 per cent. sold to private consumers, and 1·78 per cent. for lighting on the works. Of the remaining 42·75 per cent., 9·74 per cent. was used in gas-engines, and the remainder for heating, cooking, and industrial purposes. The amount taken for gas-engine use showed the large increase of 22·38 per cent. over the amount sold for the same purpose in the preceding year, owing to an increase of 28 in the number of motors, representing an increase of 241 in horse power.

It is difficult to compare the quantities of gas consumed for different purposes with the amounts used for similar purposes in English towns, because it is not the custom in this country to provide separate services. There is no question, however, that the proportion of gas sold for purposes other than lighting in Crefeld is very much higher than generally obtains here. The difference is due chiefly to the fact that differential prices for gas are the rule in Crefeld, as in most German towns. Gas for illuminating purposes is charged for at prices ranging from 2s. 10d. to 5s. 6d. per 1000 cubic feet, according to the quantity taken by the consumer in the course of the year. Gas for other purposes, however, is sold to all alike at the universal price of 2s. 10d. per 1000 cubic feet. As a matter of fact, only the larger customers obtain gas for illuminating purposes at a less price than 5s. 6d., for that is the rate charged except the amount consumed exceeds 211,860 cubic feet per annum. The average price obtained for gas used for illuminating during the last year was, however, only a little over 5s. per 1000 cubic feet. Only two consumers obtained their supply at the lowest rate of 2s. 10d. per 1000 cubic feet. Had all the consumers been charged the average price of 5s., these two consumers would, we gather, have had to pay some £1400 per annum more for their gas; and it is not unlikely that they would, under such circumstances, have found an electric lighting plant a profitable investment. The Crefeld report, moreover, indicates that the low price being charged for gas used for other purposes than lighting creates a large demand. Had gas been sold at the uniform price of 4s., which is about the average of the prices actually obtained, it is certain that considerably less would have been sold for purposes other than lighting. Whether the low uniform price would have brought up the illuminating consumption sufficiently to compensate for the decreased sales for other purposes, is a moot point, which each of our readers will decide according to the bent of his sympathies. It may, however, be pointed out, in extenuation of the German policy of charging a high price for gas for lighting purposes, that in that country the only alternative popular illuminant—viz., petroleum—is also dear, owing to heavy import duties. Consequently, the German gas manager does not feel so intensely as his English *confrère* the necessity for selling illuminating gas at the lowest possible price, in order to meet the competition of duty-free petroleum. But there appears to have been no reason why gas should not have been sold at Crefeld at a uniform price of a little over 3s. per 1000 cubic feet, had the Municipality been content to forego a profit of some £11,500 on the year's working. The practice, however, of selling gas at abnormally high prices in order that profits may be made for the municipal coffers, is one with which we are familiar in the case of many English municipal gas-works. We regret to find the system prevails also at Crefeld and other Continental towns.

The coal carbonized during the year ending March 31 last amounted to 29,630 tons, and cost on the average nearly 13s. 3d. per ton. The cost was lower than in previous years. The make of gas per ton of coal was 10,260 cubic feet; and the yield of coke was 70·82 per cent. of the weight of coal carbonized. The coke consumed in the retort furnaces amounted to nearly 27 per cent. of the coke obtained, corresponding to 19 per cent. of the coal carbonized. The average price secured for the coke which was sold was nearly 12s. 6d. per ton. The crude gas liquor contained on the average 1·55 per cent. of ammonia—*i.e.*, the liquor was of about 7 "ounces" strength. It was worked up into concentrated liquor, containing on the average 19·75 per cent. of ammonia. The returns from the manufacture and sale of this concentrated liquor amounted to 1½d. per 1000 cubic feet of gas sold. The washing and scrubbing plant worked very satisfactorily; and the average amount of ammonia found in the finished gas was only 0·4 grain per 100 cubic feet. Sulphuretted hydrogen was occasionally present in traces in the purified gas; but the sulphur compounds as a whole did not, on the average, exceed 9·2 grains of sulphur per 100 cubic feet. This unusually high degree of purity was, so far as one can judge from the report, secured by the use only

of oxide (or perhaps one of the preparations consisting chiefly of ferric oxide which are extensively used on the Continent) as a purifying material. Clearly, therefore, the coals carbonized must have had an uncommonly low content of volatile sulphur. The oxide was used, however, with scrupulous care, in order to facilitate the recovery from it of the cyanogen compounds present in the gas. As is well known, it is essential to the production of ferrocyanide in oxide from these compounds that the gas entering the purifiers should be virtually free from ammonia; and it is further necessary, in order to prevent the ferrocyanide being broken up, that the heat of the mass during revivification should not become excessive. By due attention to these essential points, the Crefeld works produced spent oxide yielding over 6 per cent. of prussian blue, and containing very little of the objectionable alternative cyanogen products—viz., sulphocyanides. The value of the prussian blue recovered from the spent oxide more than sufficed to recoup the works for the cost of new oxide.

In these and other matters, the works laboratory rendered invaluable assistance; while it also carried out large numbers of testings of a very interesting character, but of less direct utility to the works management. Among these, may be quoted periodical analyses of the gas delivered to consumers, from which it appears that the following represents its mean composition in percentages by volume: Carbonic acid 1·85, heavy hydrocarbons 3·53, oxygen 0·26, carbonic oxide 7·22, methane 33·74, hydrogen 47·96, and nitrogen 5·44. The average illuminating power of the gas was such that, if the testings had been made on the English methods, it would have been returned as about 14 candles. The management recognized the continually increasing importance of high calorific value; and the gas was examined almost daily with a Junkers calorimeter. Its mean calorific value was rather more than 150 calories per cubic foot, which is very good for 14-candle coal gas. The average specific gravity of the gas was 0·396. The amount of water formed by combustion of a given volume of the gas was also ascertained, and found to be equivalent to 418 grains per cubic foot.

The comprehensiveness and close attention to detail which characterize the laboratory operations appear to have extended to all parts of the works, though naturally they cannot be indicated by such evidence as the analytical data quoted above affords in the case of the laboratory. We have, however, now said enough to show that the Germans are mastering the *technique* of gas manufacture with the same thoroughness which they have brought to bear on many other industries which were once almost restricted to British enterprise. Many points to which the German gas manager gives attention are regarded by his English *confrère* as insignificant, and unworthy of care amid the manifold operations which cannot be neglected, if consumers are to obtain a more reliable supply of gas than the fickle current which electricity supply works grant their customers. But the German gas manager has an equal responsibility in this respect, though we admit he is rarely so restricted in regard to the quality of his gas supply as are many English managers. Yet is he able to turn also to the many apparently trivial details of manipulation and procedure which bridge the gap intervening between our present practice and perfection in gas manufacture and distribution. Many of us may learn much from an intelligent study of a progressive German gas undertaking, such as that of Crefeld, and no one will find the study totally fruitless.

THE MUNICIPAL LIFE OF GLASGOW.

UNDER the title of "Notes on Municipal Work from November 1896, to November, 1899," Sir David Richmond has recently presented to the Corporation of Glasgow a *résumé* of the work done by the Municipality in the three years during which he filled the office of Lord Provost of the city, with special reference to the inauguration of any new schemes for the benefit of the citizens, or the extension and development of existing lines of policy. We have received a copy of the report,* and abstract some of the facts most likely to interest our readers.

Sir David entered the Council in 1879; and the intervening twenty years have seen great changes in the very progressive and much municipalized city of Glasgow. In 1879, the area of the city was 6111 acres, the population 505,000, and the valuation of lands and heritages £3,432,112; whereas at the present time the city comprises 12,688 acres, with a population of 747,222, and a valuation of £4,780,000. The work of the Corporation has, however, increased at an even greater ratio. New departments—such as tramways, electricity, baths and washhouses, municipal buildings, and sewage disposal—have added their burden to the shoulders of the Corporation; while the older departments have grown amazingly. The details of this work are fully set out in Sir David's report. Among the subjects specially referred to, are the promotion in Parliament of important Bills to obtain powers to carry out works in connection with the city improvements, tramways, gas, sewage, and other departments, involving the expenditure of two to three millions sterling; the projected substitution of electric traction for horse power on the tram lines; the rebuilding of the congested areas in the poorer quarters; the practical completion of the duplicate aqueduct from Loch Katrine; the obtaining of powers for the erection—at an estimated cost of a million sterling—of the new Provan gas-works; the erection of the Port Dundas and Pollokshaws Road power stations for the Electricity Department, and the acquisition of the undertaking of the Kelvinside Electricity Company; the extension of the electric lighting of the city; and many other subjects illustrating the onerous and diversified tasks undertaken by the Glasgow Municipality. This vast bulk of enterprise entails, of course, the use of a large amount of capital, obtained by means of Corporation loans (amounting, on May 31 last, to £7,669,340), in connection with which Sir David points out that, owing to the low average rate of interest and the marvellous growth in the assessable rental of the city, the burden of increased and increasing debt has not been appreciably felt. But he thinks it necessary—a notable fact—to warn the members of the Corporation that, "unless capital expenditure is kept within bounds, and made to correspond with the expansion of the city, the growing charges for interest and sinking fund will necessitate in the near future increases in rates and taxes." Coming from such a source, it is to be hoped that this warning will not be unheeded. The Lord Provost points out, with justifiable satisfaction, that Glasgow has been able to borrow very cheaply—"more cheaply, probably, than any other Municipality. The rate of interest reached its lowest level about three years ago, when the Corporation obtained par for 2½ per cent. stock." Since then various causes, chief among which has been the great expansion of trade, have tended to raise the value of money, and thereby to lower the market price of gilt-edged securities. The most striking departure in the financial operations of the Corporation during the period under review was, in Sir David's opinion, the issue of Glasgow Corporation promissory notes, which proved a very successful method of raising money. The London County Council have similar powers to those possessed by Glasgow; but the latter city claims to have pioneered the innovation.

The review of the work of the Gas Department shows very clearly the rapid increase in the sale of gas in the city, in spite of the activity of the rival Electricity Department. The annual output of the gas-works rose in the last three years from 4812 million to 5772 million cubic feet—an increase equal to about 6⅔ per cent. per annum. To provide for the increasing demand for gas, capital to the amount of £278,566 was spent, chiefly on a retort-house and fittings at Dawsholm, a gasholder, retort-house, purifiers, and other plant at Tradeston, and a gasholder at the Temple works. It was also necessary to lay a further 60 miles of mains, and to spend nearly £50,000 on new meters. The Dawsholm and Tradeston chemical works, owned by the Corporation, but worked by contractors, have been altered and enlarged in order to deal with the increased make of tar and ammoniacal liquor. The large increase in the sale of gas is ascribed by Sir David Richmond in great measure to the reduction in the price, in 1896, from 2s. 4d. to 2s. 2d. per 1000 cubic feet—a price (the lowest on record for Glasgow) contrasted by him with that of 4s. 7d., which was being charged when the Corporation took over the gas supply in 1869. The works now supply an area 15 miles in extreme length by some 10 miles in extreme breadth. Reference is made to the Provan gas-works now in process of construction—rendered necessary by the fact that the Dalmarnock works did not permit of extension. It is intended to close the latter on the opening of the Provan works, which are designed for the manufacture of about 40 million cubic feet a day, or more than double the capacity of all the existing works put together. The record daily delivery was that of 31,124,400 cubic feet on Jan. 29, 1899. It is obvious therefore, that the new works will provide a considerable, margin for increased consumption. The Dalmarnock works are being heavily written down, in view of their eventually being closed.

The Water Department has, besides the ordinary work of supply, been occupied during the past three years with the final stages of the new aqueduct from Loch Katrine to Glasgow, which, with the subsidiary works, has been in course of construction for some years; the necessary powers having been provided by the Act of 1885. Of the total length—23¾ miles—of aqueduct to be constructed, 22¼ miles are actually completed, and in use; and the remaining 1½ miles will very shortly be finished. Other work at Loch Katrine, which it was expected, at the time of Sir David's report, would be completed by the end of last year, will enable the water in the loch to be raised to a height of 5 feet above the present top-water level, thereby increasing the storage capacity of the loch from 5623 million to 9849 million gallons. This raising of the level of the famous loch has involved considerable labour in the replacing of the shore-roads and the felling of the timber on the banks, which will be thereby submerged. This work has been done by the employees of the Water Department; but the actual dam as well as the outlet works have been executed under contract. The additional supply rendered available by the new aqueduct, as far as already completed, has resulted in a considerable improvement in the pressure and constancy of the supply in the higher districts of the city and suburbs. The consumption per head of population has risen in the three years from 50 to 54 gallons per day. The hydraulic supply works are using an increasing quantity of water; their consumption at present exceeding 90,000 gallons per day. Careful soundings of Loch

* Published by Robert Anderson, Glasgow.

Katrine have determined the depth to be 751 feet—a depth which tends to keep the water cool in summer and warm in winter, while it is said to contain fewer micro-organisms than the water in some of the shallower lochs in the district. Attention is called to the material reductions made in April last in the charges for water; the rate being lowered from 6d. to 5d. in the pound, and the charge for water by meter being reduced from 33s. 4d. to 30s. per 100,000 gallons. The reductions are estimated to cost the revenue account £18,000 per annum. The revenue had, however, risen in the three past years from £189,713 to £216,744; so that the lower rates are evidently justified. The department has expended just on a quarter of a million sterling in the three years; and the capital cost of the undertaking now stands at just over 3¾ millions.

The Electricity Department has also been very busy during the term of Sir David Richmond's office; the capital account thereof having risen from £131,962 to £339,782. This heavy expenditure, necessitated by the constantly increasing demand, has been upon the provision of two large storage batteries—the largest in the United Kingdom—giving a combined supply equal to 700-horse power for two hours, and two new generating stations. £37,000 was also spent on the acquisition of the Kelvinside Electricity Company's undertaking. The Kelvinside is a rapidly growing district; but the works, though at present only small, are capable of considerable extension. The quantity of electricity sold in the third of the three years reported upon was practically double that in the first; being 2824 thousand units in 1898-9, as compared with 1498 thousand units in 1896-7. The Corporation now charge private consumers on the demand-indicator or "Brighton" system. The average prices charged in the years ended May 31, 1897, 1898, and 1899 were 5·09d., 4·36d., and 3·89d. per unit respectively.

In connection with the subject of public health in Glasgow, the report specially mentions that two smoke inspectors were appointed a few months ago to deal with the smoke nuisance. On this question, Sir David says:

> The delicacy and difficulty of the work is quite recognized—that, on the one hand, there may be no avoidable interference with our manufacturing industries, while, on the other, the best possible atmospheric conditions are secured for the general community. Care will, however, require to be taken that the Corporation do not assume responsibility by their inspectors making suggestions as to the adoption of any special machinery or alterations on works—the responsibility for taking whatever steps are necessary for the prevention of smoke nuisance must rest with the manufacturers. It is hoped that, by a quiet, firm, and constant pressure, the improvement which we all (manufacturers and non-manufacturers alike) so much desire may be gradually effected.

The outcome of this attempt to obtain the longed-for smoke nuisance abatement will be watched with interest, and not least by the other Richmond in the field.

From the section on sewage purification works, we learn that a determined effort is to be made to restore the Clyde, "which for so many years has been little better than an open sewer," to something like purity. The cost will be between one million and a million-and-a-half sterling.

We have now touched briefly upon all the points of special interest to our readers; but the whole report is worthy of study. Its perusal gives one the impression that in Glasgow the citizens just elect the Corporation—the Corporation do all the rest.

PROMOTERS IN PARLIAMENT.

THE paramount interest of news from the seat of war has for some time, and necessarily, overshadowed various subjects which under normal circumstances would have been prominently noticed in the newspapers. Law reports have been ruthlessly curtailed to suit the exigencies of space, and important legal decisions which on other occasions would have furnished texts for leader-writers have been allowed to pass almost unnoticed. Even in times of peace and quietness, the results of trials on circuit receive briefer treatment than those disposed of at our Temple of Justice in the Strand, though the *venue* is not always a fair test of the importance of the litigation. Be that as it may, the case of *Jackson v. Clough*, recently tried by Judge and Jury at Leeds, deserves, for various reasons, attentive consideration at the hands of all who are concerned with the promotion and flotation of joint-stock companies. In the form of the action there was nothing unfamiliar. Mr. F. S. Jackson sued Mr. W. O. Clough, M.P., for damages in respect of alleged false and fraudulent misrepresentations, and also of certain alleged untrue statements contained in the prospectus of the India-Rubber Company, Mexico, Limited. Stated without undue technicality, the plaintiff's grievance was (1) that he was induced to underwrite £2000 in debenture stock of the above Company by the representation that the defendant, who was connected also with a concern called the Mexican Finance Corporation, Limited, had made no promoter's profit on the transfer of certain india-rubber estates; (2) that the India-Rubber Company, Mexico, Limited, did not acquire, notwithstanding affirmative representations, two large estates upon which there were 350,000 trees available for tapping.

According to the plaintiff's Counsel, Mr. Clough was the projector of the whole enterprise, having acquired the Mexican property which was to be resold first to the Finance Corporation and then to the India-Rubber Company. On the other hand, Mr. Clough disclaimed all intention to mislead Mr. Jackson or anyone else; and he pointed to the report of an expert (Mr. Abram) as justifying all that had been put forward in the prospectus of the Company. It appeared that in 1889 somebody acquired the concession, and a condition of the purchase was that the concessionaires bound themselves to plant in the first year 300,000 trees, and in each subsequent year 550,000 trees, until a total of 15,000,000 trees was reached. They were to be planted on the Pacific Coast—rather a vague locality. At any rate, events proved at the trial that the trees never had been planted on the estates which were put forward as an excellent investment for the British public. In short, the amazing failure of those concerned to distinguish between the past tense and the future tense—between what was promised and what was performed—seems to have been at the root of the entire *fiasco*. But what of the expert's report? This might have availed to cover Mr. Clough's position, but for the Judge's view that the defendant already had before him data which made it incredible that Mr. Clough could have believed what the expert had to say on the subject of these evanescent rubber trees. One broad and striking fact was patent. In 1891 there were no trees on the estate; but now, according to the expert, there were 30,000, and a sufficient number of them ready for tapping to the tune of £70,000 to £80,000 a year!

But Mr. Clough was not the only member of Parliament upon whom the presiding Judge—Mr. Justice Grantham—had strictures to pass in connection with this extraordinary example of company promotion. It seems that Mr. Allen, M.P., was sent out to Mexico to inspect and report on the position of affairs. But his Lordship's difficulty was to discover what Mr. Allen did when he got there, and in what way he earned the £1900 which was paid to him for his services. Taking one consideration with another, Mr. Justice Grantham hinted plainly to the Jury that the House of Commons nowadays is used for other purposes than politics, and that the lobbies of the House are the "happy hunting-ground" of the company promoter.

Undoubtedly, this India-Rubber case does give rise to very suggestive reflections, both as to the ethics of company promotion and the use or abuse of the initials "M.P.," and all that those once-respected initials imply. But the point of more practical importance is that which is involved in the value of an expert's opinion. Let it be clearly understood that directors cannot in all circumstances shelter themselves behind these so-called "expert" opinions of others. Section 3 of the Directors' Liability Act, 1890, while making directors liable for statements in a prospectus "not purporting to be made on the authority of an expert," expressly qualifies the exemption by requiring it to be proved not only that the protected statement was made on such authority, but that the director had reasonable ground to believe, and did up to the time of allotment believe, that the statement was true. Moreover, the belief must not be merely a blind belief; and the director will still remain liable, in spite of the most glowing report that an imaginative or unscrupulous expert ever compiled, if it be proved that there was "no reasonable ground to believe that the person making the statement, report, or valuation was competent to make it." The term "expert," it should be added, includes, for the purpose of the Act, "any person whose profession gives authority to a statement made by him." In the Leeds case, the learned Judge and the Jury (who returned a verdict against Mr. Clough) considered that that gentleman was not entitled to "take cover" behind Mr. Abram. In short, the lesson of the trial is that directors should be as critical of the experts they employ as shareholders should be of their directors.

MINOR LOCAL AUTHORITIES AND WATER AND DRAINAGE QUESTIONS.

THE ineptitude of local bodies of the minor sort in dealing with questions of water supply and drainage has on many occasions furnished the theme for critical comment in the "JOURNAL;" and the action, or inaction, of the Havant Urban District Council in regard to these vital problems is quite in accordance with familiar traditions. It seems that two places called Darranth and Redhill are outlying portions of the Town of Havant, which includes within its boundaries the pumping-stations and main sources of supply of the Portsmouth Water Company. Havant itself, therefore, possesses in the matter of water supply advantages which might fairly be envied by most towns of equally small population. The two outlying districts above mentioned, however, are not at present included in the Company's area; but the Company have long been ready and willing to supply the district with water, provided the District Council will guarantee the minimum revenue contemplated by the Legislature. In the minds of the members and officers of the Council, considerable doubt appears to have existed with respect to the intentions of Parliament; and it may be gathered, from some remarks made at a recent meeting, that the subject has repeatedly engaged the attention of the members of the Council sitting in Committee. We may point out that the position is governed by section 35 of the Water-Works Clauses Act, 1847, which, after enacting that a supply of pure and wholesome water for domestic use shall be provided and kept in the pipes for those who are entitled to demand a supply, goes on to declare that "the

undertakers shall cause pipes to be laid down and water brought to every part of the town or district within the limits of the Special Act whereunto they shall be required by so many owners or occupiers of houses in that part of the town or district as that the aggregate amount of water-rate payable by them annually at the rate specified in the Special Act shall be not less than one-tenth part of the expense of providing and laying down such pipes." There is a proviso that no such requisition shall be binding on the undertakers unless the owners or occupiers shall severally execute an agreement binding themselves to take such supply of water for three successive years at least.

Of course, in the whole of the Water-Works Clauses Act there is no more familiar section than the one just cited. But the Havant Council seem to have thought that the enactment did not enable the Council as a Local Authority to give the statutory undertaking. This desire to keep scrupulously within their powers may, in some respects, be commendable; always assuming that the wish was not "father to the thought." If, however, the Portsmouth Water Company were prepared to accept the responsibility of the Council, it is difficult to understand why so much diffidence has marked the conduct of those whose plain duty it is to see that their constituents are provided with one of the prime requirements of life. At any rate, there need be no further hesitation on the part of Havant. The Local Government Board, when appealed to for guidance, advised the District Council that there is nothing to prevent them from giving the Company the required guarantee, and, in effect, that it ought to be given. This official view of the scope of section 35—a view which doubtless is based on an authoritative legal opinion—may be commended to the careful attention of other District Councils throughout the country. Meanwhile, all excuse for further procrastination on the part of the local body immediately concerned is absolutely at an end.

In connection with the question of drainage also, official correspondence with the Havant District Council affords at the same time another lesson which in various quarters should be laid to heart. Not very long since, the same Water Company had to set the Public Health Act in motion for the purpose of compelling those who bear rule in Havant to dispose satisfactorily of the sewage of their district—a question necessarily of vital moment to the Company and the population of Portsmouth. The outcome of the inquiry entirely justified the action of the Company. But the local idea of dealing with this important problem may be gathered from another letter addressed by the Local Government Board to the District Council. The following is the most significant portion of the communication: "The Board gather that it is proposed to discharge the effluent from septic tanks and filter-beds direct into the mill-stream; and they direct me to state that they are not prepared to accept as satisfactory any scheme of sewage disposal which does not provide for the treatment of the sewage effluent upon an adequate area of suitable land prior to its discharge into the stream." The brilliant notion of the Havant Authority seems to have been to borrow money first and work out the drainage scheme afterwards; but the Local Government Board plainly intimate that this method of putting the cart before the horse is not in the fitness of things. The first step, of course, should be to settle a provisional agreement for acquiring land suitable in area and situation for treating the sewage effluent. If the mill-stream were to be poisoned in the manner contemplated, the remedy for Havant's present sanitary shortcomings would probably prove infinitely worse than the disease.

The Bronze Coinage.—In the "JOURNAL" for the 19th ult., reference was made to the difficulty arising from the scarcity of coppers owing to the largely extended use of "penny-in-the-slot" gas-meters and other machines of like character for the automatic delivery of commodities. This "shortage" was felt notwithstanding a very great increase in the number of bronze coins struck at the Mint last year as compared with 1898; the numbers being 42,413,700, against 26,902,096. The value of the bronze coinage issued last year for the United Kingdom was £130,055; whereas in 1898 it was only £75,070.

Mr. C. Vernon Boys, F.R.S., on "Fluids in Motion and at Rest."—We are not surprised to read that a great audience, composed nominally of juveniles, but mainly of middle-aged and elderly people, were charmed last Thursday with the first of the six "children's" lectures on the above subject which Mr. C. Vernon Boys, F.R.S., one of the Metropolitan Gas Referees, is delivering at the Royal Institution. Many of us remember how the late Professor Huxley used to delight us with his discourses on natural history, at the Museum of Practical Geology and elsewhere; and we know with what interest Mr. Boys can invest so common an object as a soap-bubble. It may therefore be concluded that his lectures will be profitable to a far larger audience than that for which they were originally intended. The first lecture of the course is noticed here mainly to call attention to the fact that, when describing the action of the syphon, Mr. Boys took the opportunity of enlightening his adult hearers on the subject of the testing of London gas, in connection with which he described Mr. Vernon Harcourt's pentane lamp, and stated that this instrument, by providing a light which was always steady and constant, deserved to be called a Godsend to the gas examiners.

OBITUARY.

We regret to record the death, on the 14th ult., in his 64th year, of Mr. WILLIAM FALKNER, who was for thirty years Manager of the Romsey Gas Company. He had been ill for some weeks; and his son, Mr. F. Falkner, had been attending to his duties. Owing to his long residence at Romsey, deceased was very well known, and was widely respected.

Mr. JOHN BAIN, a well-known coal traveller in Glasgow, who did a large business with gas managers, met with an exceedingly sad death in that city on the evening of Thursday, the 7th ult. He resided in Kirkintilloch, and the 10.45 p.m. train for his home had just started from Queen Street Station when he was observed running up the platform as if to get into it. It is not very clear what happened, but it is surmised that he had attempted to get into an open brake-waggon, but had missed his hold. He fell between the waggon and the platform, and the wheels of two waggons in the rear ran over his right arm and leg, shattering both of them. The poor sufferer was taken to the Royal Infirmary, where he died in the course of the night. Mr. Bain was of a lively temperament—in fact, he overflowed with cheerfulness. He regularly attended meetings of gas managers, and was always the centre of a mirthful group. He was so much respected that his funeral was made a public one.

The Kingston Gas Company have just sustained a great loss by the death, early on Christmas Day, of their Chairman, Mr. PHILIP JONES. Deceased had for a long time been troubled with an asthmatic affection; but, although in his 82nd year, he was attending to business on the day prior to his death, notwithstanding the fog which prevailed. Mr. Jones's connection with the Company dates back 36 years; he having in 1863 been appointed an Auditor. The duties of this office he discharged till Aug. 26, 1880, when he was elected to a seat on the Board. On Nov. 3, 1892, he was appointed Chairman, in succession to Mr. J. Page, deceased, and he continued to discharge the duties of this office up to the time of his death. The Directors met last Thursday—the Vice-Chairman (Alderman Bedford Marsh, J.P., presiding—and, out of respect for the memory of the deceased, and the cordial relations which had ever existed between them and their late colleague, they decided to adjourn for a week. The Secretary (Mr. J. A. Fricker) was directed to send to the deceased's relatives a letter expressing the deep sympathy and condolence of the Board with them in the bereavement they have sustained, and a sincere acknowledgment of the lengthened and valuable services which Mr. Jones had rendered to the Company. Deceased had resided in Kingston nearly all his life, and had been a member of the Town Council, an Alderman, an Overseer, a Charity Trustee, and a Justice of the Peace. The funeral took place last Saturday.

PERSONAL.

Mr. J. W. GIBSON is to succeed his brother, Mr. Brooke Gibson, as Manager of the Haverhill Gas-Works.

Mr. F. J. FALKNER has been appointed Manager and Secretary of the Romsey Gas Company, in succession to his father, whose recent death is noticed above.

The Gas Committee of the Bingley District Council have accepted with much regret the resignation of Mr. G. DUNBAR MALAM, their Engineer and Manager, referred to last week; and his engagement will terminate on the 31st of March. It will be seen, from an announcement which appears elsewhere, that the Committee are inviting applications for the position.

The funeral of the late Mr. JOHN WILLIAMS, Secretary of the Devonport Gas Company, whose death was recorded in the last issue of the "JOURNAL," took place on Sunday, the 24th ult., at the cemetery at Milehouse, Devonport. Eight employees of the Company were the bearers; and the different departments were all represented. Among the wreaths was one from the office staff, and another from the workmen.

The Finance Committee of the Birmingham Corporation have decided to recommend Mr. THOMAS H. CLARE for the position of City Treasurer, in succession to the late Mr. W. R. Hughes. Mr. Clare has been closely associated with the City Treasurer's Department for many years. He was originally with the Birmingham Gaslight and Coke Company; but when the undertakings were acquired by the Corporation in 1875, he entered the service of the Gas Department. He remained there until 1887, when he was appointed Deputy-Treasurer.

Among the New Year honours conferred by Her Majesty, we are pleased to notice the dignity of a peerage for Sir JOHN LUBBOCK, Bart., M.P. In addition to being head of the banking firm of Messrs. Robarts, Lubbock, and Co., Sir John is a Director of various Companies, and President of the Association of Bankers. His elevation calls for notice here from the fact that he is a careful scientific observer, and has been President of several learned societies. He also did good work as Vice-Chairman of the London County Council from 1888 to 1890, and as Chairman from 1890 to 1892. Addressing the Council, at their meeting on the 2nd of June in the last-named year, on the proposed acquisition of the London Water Companies' undertakings, he confessed to being one of those who believe that undertakings of this character are, as a rule, more economically managed by private enterprise than by public bodies. This opinion he has held ever since; and it may be said that generally he is averse to Municipalism.

NOTES.

A Suggested Theory of Light.

A correspondent of the "Engineer" offers, very tentatively, a solution of the problem of the transmission of light, which he describes as a modification of Newton's corpuscular theory. It is pretty generally admitted that there are grave difficulties in the way of complete faith in the undulatory hypothesis, and especially that the supposititious ether of the physicist is strained almost beyond any reasonable burden in the endeavour to make it carry all the phenomena now associated with light. Consequently, there are those who are inclined to think that the corpuscular theory may not be quite dead. The great objection to it, in its simplest expression, is that it is inconceivable that any particle of ponderable matter flying at the velocity of light, or 198,000 miles per second, could come into contact with the eye without destroying it. The suggestion put forward is that it is feasible to imagine light transmission as going forward by impulse through a chain of perfectly elastic little spheres, all in contact, like a row of pyramid balls on a billiard table. Unhappily for this idea, the mechanism described is familiar to physicists, who employ it to illustrate other concepts of natural forces and agents; but it would not explain the phenomena of light and analogous radiations without exercising the scientific imagination even more exhaustingly than the ether itself.

Domestic Uses of Gas.

A writer in the "Ironmonger" discourses very entertainingly on the tendency of inventors to devote their cleverness to the production of things which nobody wants, while neglecting crying needs of the age. He remarks that now is the golden time for inventors to look into other matters than safety sash-fasteners, of which there is already a glut, or such inutilities as "egg-top chippers," or "incandescent mantles which are a palpable piracy of existing patents;" and to turn their attention to devices for the saving of domestic labour. The existing dearth of household help is no passing phase of the labour market, but is the pressure which will bring about a thorough revolution of the working methods of middle-class households. In this emergency, there is the opportunity for the introduction of labour-saving methods and appliances with the object of reducing the drudgery of housework to its narrowest possible limits. It is remarked that "many domestic operations hitherto performed by hand can be lightened if proper forethought in the furnishing and decoration of rooms is exercised; and what with the use of machines for cleaning knives and forks, sweeping carpets, lighting fires, chopping meat, and (most precious of all) gas-stoves for cooking and heating, an enormous amount of work ordinarily involving much muscular exertion and the creation of endless dust and dirt may be avoided." If candid, unpretentious little local conferences of housewives could be held for the discussion of domestic labour-saving devices, progress in this direction would perhaps be more rapid than it is.

The Cost of Tar Macadam.

The "Builder" concludes its recommendation of tar macadam for common roads by giving some particulars of the cost of specimen works. Naturally, the cost of such macadam as is usually laid down for roadways varies with the amount of preparation of the ground that may be necessary. Where the road is an old one, and the foundation exists ready made, the only preparation required is stripping off the bad top and making good any weak places that may be discovered in the old foundation. When the road is quite a new one, the cost of making the foundation may be very considerable—as much, possibly, as 30 per cent. of the total. In a job of the kind at Canterbury, about 40 cubic yards of tar and pitch macadam were prepared from 45 yards of pit gravel, 79 gallons of tar, 284 lbs. of pitch, with 84 bushels of coke, and 30 bushels of breeze. The wages for preparing and mixing came to £7 18s. 7d.; and the cost of the other items would, of course, vary. In this case, the pitch and tar together cost about £1. The total cost of the mixture works out to 9s. 2d. per yard; and was laid to a thickness (compressed) of 4 inches. It therefore cost 18d. per yard super. The cost of stripping, ballasting with broken brick, laying the tar macadam in three coats, rolling, and finishing was 3s. per yard super. So that the total cost of the road was 4s. 6d. per yard super; calculated to last seven years, with annual repairs at 2d. a yard. At Croydon, where the original foundation was not disturbed, but the tar macadam laid directly upon it to a rolled depth of 8 inches—some of the old road metal being used up for the lowest layer of tar macadam—the total cost was not more than 3s. 6d. per square yard.

The Making of Good Iron Oxide Paint.

M. Ligot, of Auderghem, Belgium, contends, in a letter to the "Engineer," that an experience of nearly 50 years has demonstrated the superiority of a particular kind of iron paint as a preservative of iron, over every other preparation intended for the same use. The writer urges the observance of certain indispensable precautions for the successful preparation of this kind of paint. In the first place, it is necessary to use a good drying medium, without turpentine, which latter makes iron pigments run. Good, boiled linseed oil is recommended, made into a quicker drier by the addition of manganese or litharge. This question of the drier should always be taken into account in tests of iron paints against lead paints, because it often happens that the former do not receive proper treatment in this respect. Red lead paint dries hard quickly enough; but not iron oxide. The latter is more apt to form a shining skin of little adhesion to the iron, from which it consequently easily strips. This is entirely due to insufficient drying, and is no fault of the base itself. The purity of the base is another important consideration. It should always be a good natural oxide, containing 65 to 70 per cent. of ferric oxide, and never the oxide upwards of 96 per cent. pure, which is not natural, but is a chemical product. The only impurities of a sound natural iron oxide are clayey matters. M. Ligot is positive that if this kind of oxide is used as the paint base, mixed with good drying oil without turpentine, and so laid on as to dry properly, it will prove to be an iron preservative every whit as good as, and much cheaper than, red lead paint.

A Mixing-Chamber for Gases.

A curious point is made by T. Meyer in the "Chemiker Zeitung," quoted in the "Journal of the Society of Chemical Industry," of the design of apparatus for mixing gases or fluids of different specific gravities. It is remarked that if different fluids, of the same specific gravity, enter a circular basin, as in the accompanying figure (Fig. 1), with equal velocity through tangential openings of the same size, and gravitate towards a central outlet, they mix very fairly on the way. If, however, the fluids are of different specific gravities, a uniform mixing

FIG. 1.

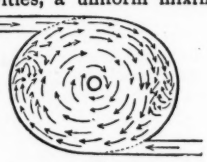


FIG. 2.

does not take place under the same conditions. This can be secured, however, by a slight modification of the shape of the mixing-basin—*i.e.*, making it oval instead of circular in section (Fig. 2). By this means, eddies are formed in the currents at the two narrow sides of the basin, as shown in the figure, and mixing ensues, even with fluids of different specific gravities, provided that the difference is not too great. The essential features of a mixing-chamber on this principle, intended for gases, are here shown. The depth of the chamber must be exactly equal to the diameter of the inlet tubes, so that the motion throughout the apparatus is uniform. The throttles, or slides, shown in the first figure, may be used to check one of the gas currents, so as to vary the proportions of the resultant mixture, taking care that the baffling of the current is not on the tangential side of the pipes. Carburetted and poor gas, or air and gas, might apparently be mixed in this compact apparatus.

COMMUNICATED ARTICLE.

FOUNDATIONS FOR METAL TANKS.

By R. J. MILBOURNE, Assoc.M.Inst.C.E.

Whenever the ground available for the erection of a new tank and gasholder is of such a nature that the adoption of the ordinary brick or concrete tank would be a matter accompanied by grave risks and expense, the dangers and difficulties may be avoided by the adoption of a metal tank. Mild steel is the material now almost universally adopted; being possessed of qualities superior to wrought or cast iron, and less in cost than the latter. But whether the material selected be steel or cast or wrought iron, the conditions necessary in the provision of foundations would be exactly the same in either case.

Substratum.—After the form of tank has been decided upon, the next, and probably the most important, point to receive attention will be the foundation upon which the strength and stability of the tank, holder, and framing depend. The chief object to be attained in the construction of the foundation, is the formation of such a solid base that a minimum amount of subsidence shall take place under the maximum load—that is to say, after the erection of the complete structure, and the tank has been filled with water. All heavy structures of this class will settle to a certain extent, for the reason that all soils are more or less compressible under the weight brought upon them.

It is not, however, sufficient to aim only at the minimum of settlement, but it is of the utmost importance to insure that whatever settlement does take place shall be of a uniform nature throughout the whole bearing surface of the foundations. Otherwise the guides of the tank and holder are liable to be thrown out of the vertical position; thus causing the accurate working of the gasholder to be impaired or interfered with in a more or less serious degree. A soft marshy ground, of even consistency, is very frequently met with, and is much more favourable for our purpose than a somewhat harder ground of varying strength or thickness, as settlement in this latter case is liable to be more unequal than in the former. The nature of the bearing strata having been carefully ascertained by trial or boreholes, the safe bearing strength of the ground per square foot of area can then be determined.

It is hardly advisable or possible to attempt to give any general rules for the safe bearing strength of the various kinds of ground

that may be met with. Each site must be judged for itself. But, speaking roughly, it may be said that alluvial soil or quicksand ought not to be loaded with more than about 1000 lbs. per square foot; a soft clay 2 or 3 feet below the surface, from 1000 to 1700 lbs.; compact clay 3000 to 5000 lbs.

Concrete Bed.—The thickness of the concrete bed upon which the tank is to be erected, though usually determined by experience, may vary from 9 inches to 2 feet or 2 ft. 6 in., according to the nature of the substratum. If the ground is soft and loose, the area of bearing surface can be enlarged by increasing the margin of the concrete bed beyond the usual allowance of 9 inches all round the outside of tank, so as to insure that the maximum pressure upon the subsoil shall not exceed the safe pressure per square foot. It should be borne in mind, however,

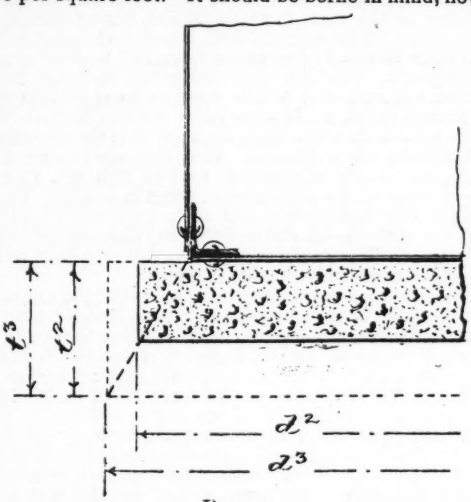


FIG. 1.

that when this increase in the diameter of the concrete bed is rendered necessary by these local circumstances, the thickness of the bed should also be increased in a certain definite proportion, in order to obtain the full advantage of the enlarged surface. As fracture is most likely to occur at an angle of about 60° with the horizontal, as shown by the thick dotted lines in fig. 1, causing the concrete bed to rupture in a number of triangular prisms, shearing or sliding over each other, the effective diameter of the concrete bed at the base may be taken as equal to the diameter indicated by d^2 in fig. 1. From this it will be apparent that, to obtain an enlarged bearing surface equal to d^3, the depth of the concrete bed should be made equal to t^3, as shown in the figure. In some extreme cases, where the increased bearing surface could only be obtained by an abnormal thickness of concrete, it might be more economical to build the tank and holder upon a foundation of piles. But this is beyond the scope of the present article.

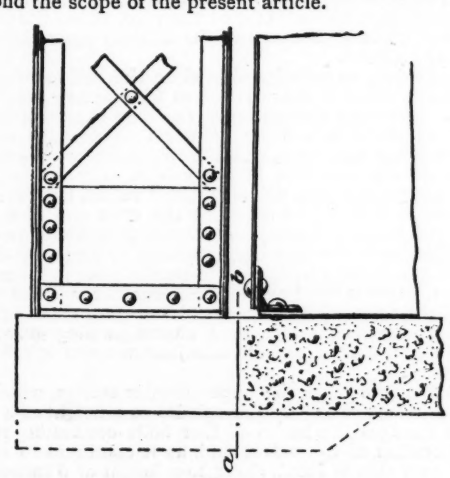


FIG. 2.

Sometimes the standards forming the guide-framing of the gasholder are secured to the sides of the tank; but when they are carried down to, and take a firm bearing on, the concrete bed, it is very important that the pressure on the substratum should be uniform. The projecting portions of the concrete bed intended to carry the standards or columns should, therefore, be proportioned accordingly. Furthermore, it may be necessary that the thickness should be increased at these points, as indicated by dotted lines in fig. 2, in order to avoid any danger of the concrete bed breaking across. The foundation for the standards is shown in fig. 2; and it may be considered as in the condition of a cantilever carrying a distributed load tending to produce fracture at A B., as indicated above. The recess which is formed in the concrete bed for the reception of the inlet and outlet pipes to the gasholder, should either be bridged over with light steel rolled joists, arched openings, or dwarf walls of brickwork or concrete, built up to afford a support for the bottom plates of the tank, immediately over this recess, after the pipes have been fixed in position and the joints properly made. This method is decidedly better than filling up the recess, or bedding both the pipes into the concrete bed in a solid mass. The small bed of concrete which is intended to form the foundation for the short vertical inlet and outlet pipes may be detached from the main tank foundation.

The horizontal pipes which pass under the bottom of tank are more reliable if made of steel instead of cast iron, owing to the flexibility of the former, which may prove advantageous in case of excessive settlement.

The character of the concrete should be made to suit the local conditions. A mixture suitable to most instances would be that composed of one part of Portland cement by measure, one-and-a-half parts of sharp clean sand, and four-and-a-half parts of broken stone, bricks, or any other suitable material. Almost any hard substance may be considered suitable when broken up, such as old clay retorts, broken earthenware, or burnt clay of an imperishable kind. Fragments of a porous nature are, however, preferable to those which possess a smooth or glossy surface, as the Portland cement will more readily adhere to them, and so form a compact and close mass free from voids. The pieces of broken brick or other material which it is intended should form the aggregate of the concrete, should be of such a size that each piece will pass through a one-and-a-half to two inch gauge or screen; the fragments being angular in shape. These materials should be carefully gauged in wooden, bottomless boxes placed on a temporary timber platform (not upon the bare ground, as it is necessary to keep the concrete clean from all earthy matter); the measuring boxes being filled up one above the other, with the matrix or cementing material on top. These boxes or frames, upon being removed, will cause the constituents of the concrete to assume a conical shape mound upon the timber platform suitable for mixing. The whole mass is then to be thoroughly incorporated by being turned over twice dry. A sufficient quantity of water, applied through a fine spray or rose, should then be added, to render the concrete plastic, and to ensure the cohesion of the various ingredients. After the concrete has again been turned over twice wet, it should be rapidly filled into barrows, wheeled to the site, and tipped into the required position in layers about 9 or 12 inches thick and carefully rammed. The ramming must not be too prolonged, or it will affect the strength of the concrete. The method of conveying the concrete down steeply-inclined wooden shoots into the exact position where it is to be deposited is very unsatisfactory, as the heavier portions of the aggregate have a tendency to collect together and separate out from the matrix; thus robbing the concrete of its homogeneity. If the concrete is more than 12 inches thick, it is advisable to use a somewhat slow-setting cement, so that the second layer of concrete can be prepared and placed in position before the first layer has had time to set. In cases, however, where it is impossible to apply the second layer until after the first layer has already set solid, the surface should be swept clean with a stiff brush, then made rough and watered. Concrete laid in cold weather stands better than that laid during hot; mild damp weather is, however, preferable to either extremes.

Excavation.—It is generally advisable to keep the tank as much out of the ground as possible, in order to afford opportunities for regular examination and painting; and also to avoid the necessity for timbering the sides of the excavation, the struts from which would materially interfere with the laying of the concrete bed. Nevertheless, the bottom of the concrete bed should always be laid at least 3 ft. 6 in. below the ground-line, to preserve the foundation from the effect of varying degrees of temperature or the percolation of rain water, which, in some soils, causes the foundations to become rent and injured by the contraction and expansion of the ground. A soft clay is very subject to expansion and contraction, owing to variations in temperature; and it is positively dangerous to erect the tank upon such a soil unless it be protected from atmospheric influence, while many soils, otherwise reliable, will assume a soft, muddy condition when exposed to the effects of the atmosphere or to rain water. When, however, the concrete bed is placed at the depth suggested, the difficulties produced by atmospheric influence are unlikely to occur in this country, owing to the protection thus obtained. The excavation should be made about 3 feet larger in diameter than the diameter of the tank, at the top level of the concrete bed, to allow sufficient room for the workmen erecting the tank to get all round the same for riveting up the sides.

Sand Bed.—To ensure the whole of the tank bottom bearing evenly and firmly upon the concrete foundations, the entire upper surface of the concrete should be made perfectly level, and then covered with a layer of clean sand about three-quarters of an inch thick. When the tank is lowered on to the foundations, the rivet heads of the bottom plates bed themselves firmly in this layer of sand, which works up between them and gives an even support to the whole area of the bottom plates.

Foundation Bolts.—It is not necessary to provide any holding-down bolts for taking hold of the standards of the gasholder guide-framing when the standards are carried down to the level of the bottom of the tank.

Fender Walls.—In most cases where the tank is erected in "made" ground, such as ashes, cinders, or town refuse, it is advisable to protect the sides from the corrosive action of this filling in. This protection can be obtained by building (say) a 9-inch brick fender wall all round the tank, or by ramming a layer of puddle, at least 9 inches thick, well up against the side plates the full depth they enter the ground.

Filling in.—It is of importance that the foundations should be kept clear of water during the laying of the concrete bed, and also while the lower portion of the tank is being erected; and as soon as the tank bottom and a sufficient depth of the side plates have been rivetted and finished complete, the tank should be carefully lowered on to its foundations, and the surrounding excavation filled in and rammed and made up to the proper level.

TECHNICAL RECORD.

AN IMPROVEMENT IN THE HYDRO-INCANDESCENT GAS SYSTEM.

In high-power incandescent gas lighting, as in other things, experience and wider application produce improvements which tend to higher results with greater economy. Some months since, we were promised by the Hydro-Incandescent Gas-Light Company, Limited, an important advance upon their then method of raising the pressure of gas for their system of lighting; and it seems they have (judging from the following information, supplied by the Company) been true to their word. The Company's old form of pressure-raiser has been replaced by the Scott-Snell compressor, or intensifying machine, which is such a compact arrangement that it does not occupy more space than a 5-light gas-meter, so that its location is not limited on account of bulkiness. In the new instrument, too, the combination of simplicity with range of utility is marked. The same machine will work over a range of water pressure between 15 lbs. and 70 lbs. with equal efficiency; and it will deliver gas at any pre-arranged pressure—that is, from the moderate increased pressure of (say) 9 inches up to 60 inches of water. The adjustment is only a matter of a few seconds; and by a simple additional appliance (a description of which is at present withheld on account of foreign patents), the machine can be made to set itself, and also become self-regulating when once coupled with the water supply—that is to say, any variation in the water pressure would be automatically met by the machine, and not by what is called "the crude unscientific process" of choking the flow of water. The machine is set or adjusted by hand for ordinary services by the simple process of sliding a block on the back of a lever and clamping it. This changes the leverage, and maintains the effectiveness of the machine at any water pressure.

Since the regulation of the machine is effected by mere change of leverage, and the movement in the gas division remains constant, it is the stroke of the water division that changes—lessening or increasing in amplitude in accordance with the rise and fall of the water pressure. This is an important point in water economy, and in great contradistinction to systems which have to fall back upon choking the water supply if its pressure is above that for which the machine is proportioned. In addition to this, accessories such as gas bells and reservoirs to control the water-inlet are avoided. Both the gas and water consumption are in strict accordance with the lights in use; the speed of the machine being naturally subject to the demand. The function of the machine is, in fact, to maintain a constant pressure of gas. It is usual to add a small drum at any convenient part of the installation, to give capacity enough to eliminate any palpitation in the circuit due to pulsation of the machine. This drum may conveniently form a pedestal for the machine. On large circuits the pipe capacity alone is, however, sufficient without the drum. The exhaust water is perfectly pure after passing through the machine, and may be used for any industrial or domestic purposes.

As regards constructive details, the machine consists of a gas-compressing division, in which is a pulsating diaphragm and a water-pressure division, in which is a smaller diaphragm; the whole system being formed by a simple arrangement of three castings, which have but a minimum of machining to fit them in position. The movement of the water piston-rod is transferred to the gas piston-rod through a compound lever with a sliding-block, whereby the leverage can be readily adjusted. The gas-valves are outside the machine, and may be examined without disconnection of any pipe joints. In regard to the over-all dimensions, it may be noted that a machine for 18 lights of 500-candle power each, occupies a ground space of about 18 in. by 24 in., and requires only about a foot in height. For large installations, a number of machines may be placed as it were in parallel, with cocks for cutting out any individual machine for examination. The opening of the machine for inspection purposes is effected with ease; and any parts can be replaced with readiness. The consumption of water required for raising the pressure of the gas is fixed at 8 gallons an hour for each light, consuming 12 cubic feet. With a water pressure of 30 inches, a 54-inch gas pressure is obtained, and the resultant illuminating efficiency is given as 46 candles per cubic foot of gas consumed.

THE OUTLET-VALVES AT THE BURRATOR RESERVOIR, PLYMOUTH.

As briefly notified in the "JOURNAL" for Aug. 1, a paper upon the above subject was read by Mr. E. SANDEMAN, Water Engineer to the Plymouth Corporation, at the recent meeting of the Institution of Mechanical Engineers in that town. Before dealing with matter specially to be considered, the author gave a sketch of the history of the Plymouth Water-Works, which date back to 1585, when the Corporation obtained an Act of Parliament which conferred power for constructing a weir across the River Meavy, and for cutting a channel or water-course, locally known as a "leat," from the weir to the town—a distance of 10½ miles in a straight line, but 17 miles along the course taken. The weir and leat were constructed in 1591 by Sir Francis Drake, and were the means of supplying the town for 300 years. The Act authorizing the construction of the Burrator reservoir and of the pipe-line to supersede the leat was passed in 1893. It is situated on the western slope of Dartmoor, and contains 651 million gallons; the top water-level being 708 feet above the sea. The reservoir is formed by two embankments—one of masonry 77 feet high (fig. 1), and the other of earth with a puddle core 23 feet in height. The outlet-pipes are three in number; and their sizes are 36, 30, and 25 inches respectively—the latter being the diameter of the town's supply-main. The author then proceeded to describe, as follows, the manner of controlling these pipes:—

It is well known that great power and strength are necessary in valves which have to be used against a considerable head of water; and especially is this the case when the closing of the valves is in process. At the Burrator water-works, the largest pipe is estimated to be capable of delivering 200 million gallons per day; and in this instance the force to be reckoned with is equivalent to a weight of 36,000 tons travelling at the rate of 36 miles per hour, or ten tons travelling 52½ feet per second. It will be apparent that unless this force is brought to a standstill slowly, a considerable shock must inevitably result. The outlet-pipes from the reservoir are provided with valves on the inside as well as on the outside of the masonry dam. On the down-stream side are placed the valves which are for ordinary use. With the exception of two, these valves are arranged so as to be in one valve chamber. The 36-inch and 25 inch pipes, which were laid in the 10-feet outlet tunnel through the dam, divide into four pipes, which are respectively 36, 30, and two 25 inches in diameter (fig. 2). The 36-inch and the 25-inch pipes continue directly into the weir pool. These pipes are used in emptying the reservoir. When used in conjunction with the 30-inch pipe at a higher level, the reservoir is emptied in 2¼ days.

For ordinary use there are two valves on each pipe—each of a different kind. That nearest to the reservoir is the ordinary double-faced sluice-door with a bye-pass; while the second one is a double-spindled valve, having two doors, the smaller of which, being about one-seventh the area of the larger, is intended to be opened first, thereby relieving to some extent the pressure against the larger one. It would probably have been an improvement on these valves had their sectional area been reduced to from one-third to one-half that of the pipe, as, on the principle of the Venturi tube, the loss of the delivery power of the pipe would not be great.

Special valves were designed to close the bell-mouthed ends of the outlet-pipes, in case the valves for ordinary use required repairs. There are four valves of the type shown in figs. 3 to 6; and of these it will be sufficient to describe one—the principle being the same, and the only difference being in the number of separate lifts in the valves. The largest of the valves, which have been called "cone" valves, from their conical shape, is designed to act upon the open end of a 36-inch pipe, which has a bell-mouth measuring 48 inches across. It is divided into three circular segments faced with gun-metal (fig. 3). A 3-inch gun-metal spindle runs vertically through the centre of the valve, which is lifted and lowered together with the separate parts of the valve by gearing placed in a chamber at the top of the dam. Gun-metal rods (and chains passing over pulleys where there is a change of direction) connect the spindle to the gearing.

In opening the valve, the upper circular section, which is the smallest, is first raised by the spindle to a height of 4 inches, when it engages the heads of four bolts connecting it to the second section of the valve; and, as it continues to rise, this second part also is lifted, rising to a height of 6 inches above the third. By similar means the third section is raised from its seating to a height of 12 inches, so that the valve being fully open leaves three circular spaces through which water can enter the bell-mouth outlet-pipe. All lateral motion of the different parts of the valve is prevented by guides and stays. The total area of the spaces is nearly three times that of the sectional area of the pipe, with the object of considerably reducing the velocity of the water passing through. The action of the four valves at work has been very satisfactory. In the future design of similar valves, an air-pipe rising above water-level from the top of each valve might be provided; and for this purpose the vertical spindle might be made hollow.

The water taken from the reservoir for the town's use is measured by a Venturi meter fixed a few yards below the valve-house. The pipe on which it is fixed is 25 inches in diameter,

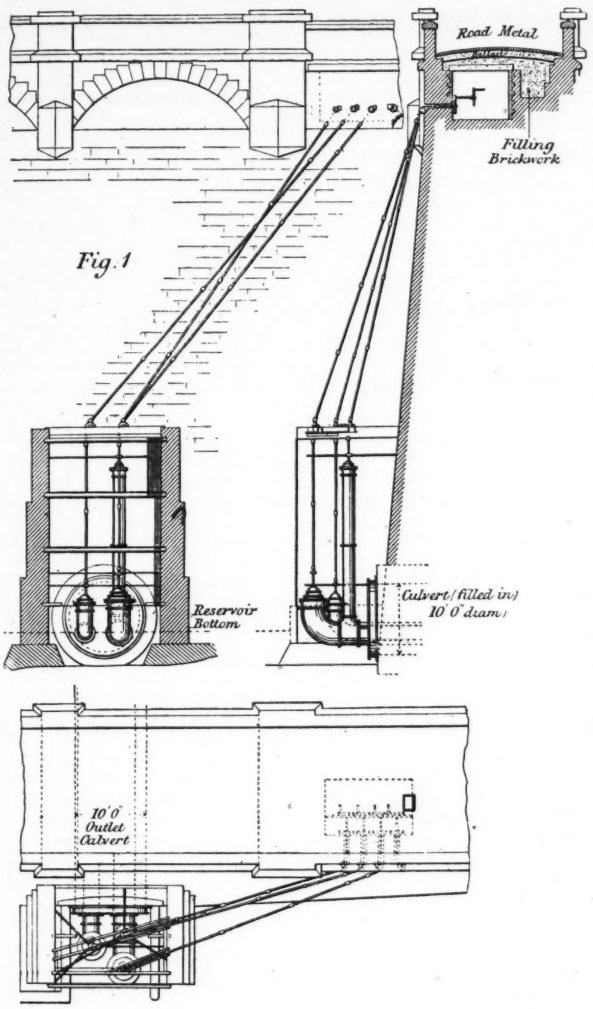


Fig. 1

which at the throat of the Venturi tube is diminished to $11\frac{3}{16}$ inches. The meter will measure quantities varying between 1 and 12 million gallons, which are recorded on a diagram; and the quantity is also given in gallons by a counter.

The discussion upon the paper was opened by Mr. J. Mansergh, who explained that his connection with the new water supply of Plymouth was in the capacity of Consulting Engineer. It was the author of the paper who had done the work. Mr. Pearson asked whether the conical valves would not "seize"

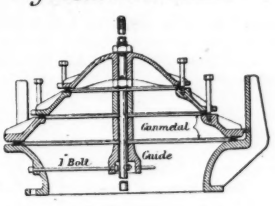


Fig. 3. Sectional Elevation.

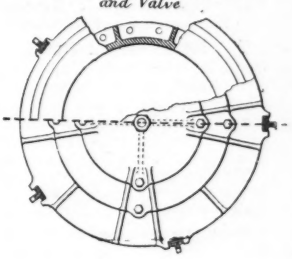


Fig. 4. Part Plans of Bellmouth and Valve

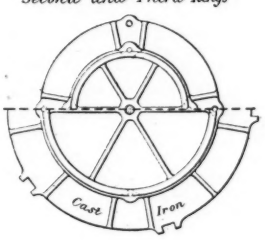


Fig. 5. Half Plans of Second and Third Rings

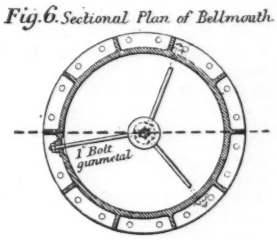


Fig. 6. Sectional Plan of Bellmouth.

in the guides which were provided to prevent lateral motion of different parts, as described. If they were to do so, there would be difficulty in lifting them, and they would then not be able to get any water through. What would be done in that case? Mr. H. Davey said he had not met with an outlet-valve like that described by the author. It was ingenious, and by it the construction of the water-tower was avoided. It had the objection, however, that it could not be drawn out for repairs; but this might be said of any valve not used in conjunction with a tower. They should consider what would happen in closing the valve under a press of water. The force might take up the slack of the rods, and would set up what he described as a "tithering" action. This, however, would not be a serious defect. At the same time, he should like to know if it had been experienced. Sir Frederick Bramwell asked why an apparatus similar to that used in water-softening plant should not be adopted. It consisted of a pipe kept near the surface by means of a float. Mr. Sandeman, in reply, thanked Mr. Mansergh for his very kind remarks. As to what Mr. Pearson had said, he did not anticipate any "seizing" of the valve. The valve referred to so often had acted well, except on one occasion, and then the trouble was due to air. He had stated in his paper, however, that the rod should be made hollow, and so let the air escape. There had been no "tithering" action as mentioned by Mr. Davey. If the floating pipe arrangement were used, as was suggested by Sir Frederick Bramwell, he did not see how the reservoir could be emptied; and in regard to the syphon arrangement, he thought the speaker did not realize that the reservoir was 70 feet deep.

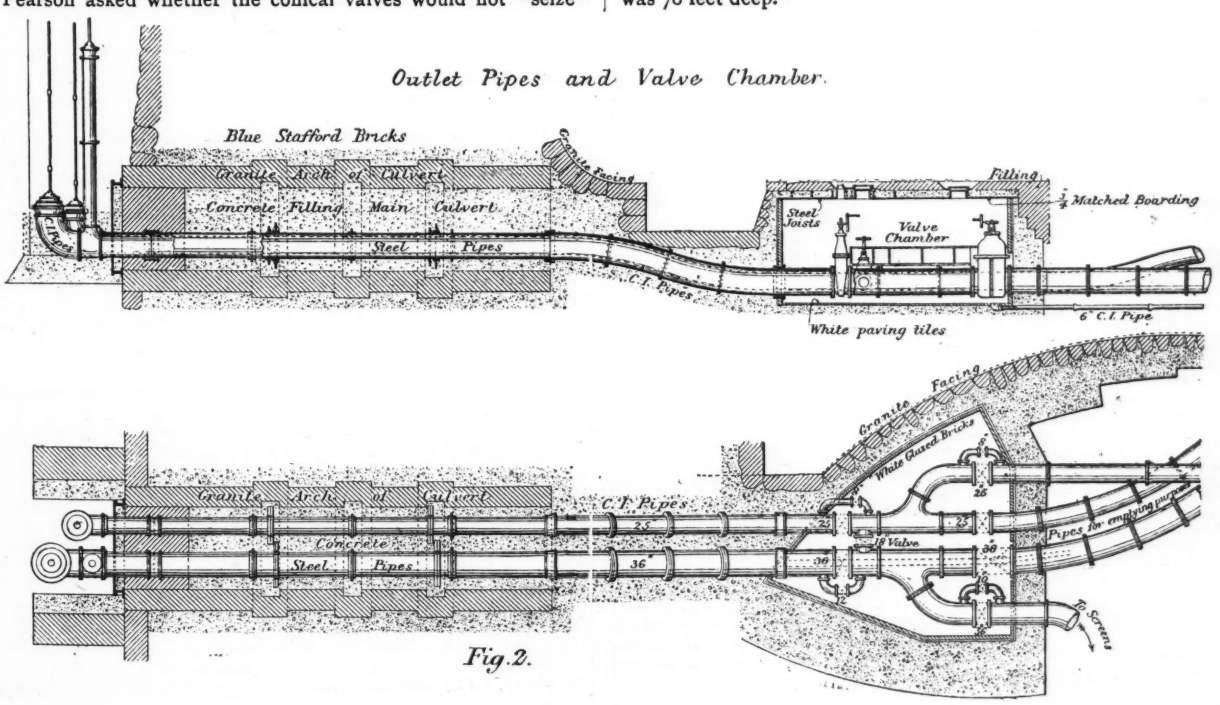


Fig. 2.

REGISTER OF PATENTS.

Unloading, Heaping, Storing, and Loading Coal, Coke, &c.—Woodward, J., of Manchester. No. 25,298; Nov. 30, 1898.

This invention relates to a combination of mechanism and arrangements by which coke or coal may be unloaded from vehicles or vessels, and heaped, stocked, or stored "in large quantity in the the least area of surface, and by the same means may be loaded from the heap into vehicles or vessels, or loaded into boxes, receptacles, or shoots so as to be readily discharged into carts or other vehicles which are to convey it away."

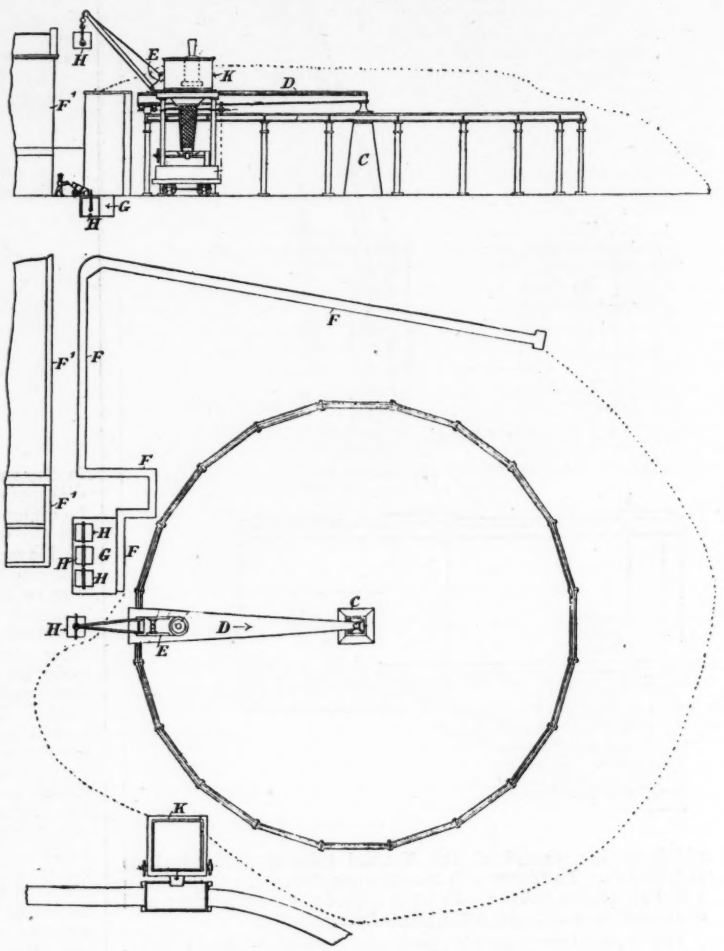
The invention—which is designed more especially for use in gas-works for storing or stocking coke, but may also be used for coal, ores, and other materials—consists in a single line (by preference) of railway, arranged in a circle of any desired diameter; the rails being beams, the vertical web of which is straight, and its upper straight edge forms the bearing or rail surface. Each beam thus forms one side of a polygonal figure forming the circular single-line railway. The adjoining ends of each two beams are secured to the upper ends of pillars arranged to extend to any desired height above the surface upon which the coke or coal is to be heaped or stocked.

In the engraving, C is a pillar in the centre of the railway, upon and around which the apex of a triangular platform D rotates. This triangular platform has, near its broad end, a central vertical pillar secured to it, upon which the crane E can swivel entirely round. This crane, which is the ordinary traversing steam-engine crane, has at the other end a jib, which carries the pulley over which the hoisting-chain passes from the winding-barrel. Like an ordinary steam-engine travelling crane, it can rotate round the central pillar, and hoist and lower, slew round its central pillar, and traverse on the railway; and it is stopped and started, as the usual type of crane, in the ordinary manner.

The traversing movement of the platform D on the railway is similar to that for driving the four wheels on two axles of a traversing crane, working on two lines of railway; but in this case it is only required to drive two axles having but one carrying wheel on each axle. It will thus be seen that the crane can hoist and lower, slew round, or travel upon or round the circular railway indicated in the engraving.

The illustration shows part of the walls and buildings of a supposed gas-works, near which the central railway is erected—F being the boundary wall of the ground upon which the circular railway is placed, and F¹ part of some of the buildings of the works near which a pit G is formed (for convenience below the level of the surface of the adjoining ground), into which buckets H are placed to be filled with coke by barrows from the gas-works. The buckets (large enough to hold 1 or 1½ tons) may be arranged to be tilted over to be emptied of their contents, or made with an opening bottom to allow the material to drop out when required.

The hook upon the hoisting-chain is hooked to the loop which passes across the bucket when it is to be lifted; it is hoisted to any desired height; and the crane is slewed round, and the platform traversed, to bring the loaded bucket over the part inside or outside the circular railway within the range of the slewing movement of the crane where the material is to be deposited.



The irregular dotted line shows the height to which the coke may be heaped; and the boundary wall in the plan and the irregular dotted line, the limit to which the coke or material may be heaped or fall to an inclination when discharged from the bucket. But if the coke is to be heaped above the level of the railway, the heaping is commenced at the furthest distance away from the point where the buckets are first lifted, and gradually approaches that point on each side as the material being dealt with is stacked.

Instead of discharging the coke upon the heap, it may be shot into a bunk K—a square receptacle standing on a framework elevated sufficiently high above the ground. The upper part of the bunk forms a box, and its lower part a hopper through which the material is discharged on to the upper end of a sloping shoot, the bottom of which is formed by bars with spaces to act as a screen and allow the small coke or breeze to pass through and into a box below; the large coke being discharged from the spout at the lower end into a waggon or other receptacle.

Incandescent Gas-Burners.—Wilson, J., of Birmingham. No. 26,488; Dec. 15, 1898.

This invention, relating to atmospheric burners suitable for incandescent gas-lamps, consists in one part of an alteration in the arrangement described in Patent No. 24,328 of 1897, and in another part of a new form of nipple burner and mixing chamber.

The burner, which is of the bunsen type, consists of the tube part of an ordinary burner surmounted by a funnel-shaped crown, through the enlarged end of which (suitably fitted with gauze or perforated metal) passes the tube part of a rod-holder, to hold the rod which, in its turn, supports the mantle to be rendered incandescent. The patentee takes the open-topped shank of an ordinary gas-burner; but instead of removing the bottom, he pierces one or more very small holes in the base for the admission of gas. The tapered and threaded end is left whole for a sufficient distance for it to effectually close the nozzle of an ordinary gas-bracket when screwed into it—generally for about $\frac{3}{16}$ inch; and immediately above this space the shank is perforated for the admission of air. The open top of the shank is slotted to receive the bar disposed crosswise as described in the 1897 patent, of which an abstract has already appeared in our columns.

Producing Illuminating Gas from Resin.—Knapp, W., and Steilberg R., of Hamburg. No. 16,619; Aug. 16, 1899.

This invention, relating to the production of illuminating gas from resin, has for its object to effect this production by a single operation; thereby essentially differing from all previous methods, in which several reactions in succession are necessary.

The process consists principally in passing liquefied or melted resin (corresponding to the gas production required) through a series of superimposed retorts filled with iron or steel turnings, whereby the resin is volatilized and subsequently gasified. The resulting gas—which is free from moisture and all impurities—is led direct into the gasholder.

The melted resin, prepared from solid lumps, is fed continuously, and in uniform quantity, from a reservoir into the upper row of retorts, where it is volatilized at a red heat. The resulting vapours are led into a second row of retorts (situated immediately under the first), and there gasified; the gas being dried by passing it through a third set of retorts in connection with the second row. It is then conveyed direct through a pipe to the holder.

The gasifying surface is greatly increased by the iron or steel turnings contained in each retort; while at the same time the flow of the melted resin is restricted so as to increase the intensity of the vaporization and subsequent gasification.

The superimposed rows of retorts, which are formed of a number of pipes corresponding in quantity to the gas consumption in view, are placed in a charging oven, where they are raised to a red heat; the vaporization and immediate gasification of the melted resin, which is fed to the apparatus in a continuous stream of uniform dimensions, is rapidly effected by the aid of the turnings contained in the pipes. Any impurities that may have accompanied the gas are retained by the turnings.

Manufacturing Acetylene.—Kellner, C., of Golling, near Salzburg, Austria. No. 21,035; Oct. 20, 1899.

This invention relates to the regular evolution of acetylene from carbide, by decomposing it by means of a solution of chloride of calcium or calcium oxychloride.

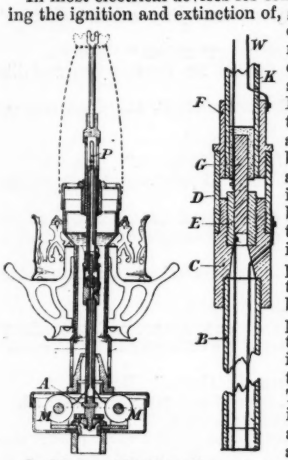
In explanation of his invention, the patentee remarks: "The violent and irregular evolution of acetylene which occurs when calcium carbide is brought into contact with water, and the phenomenon known as 'after-evolution,' form, as will be known, the principal difficulties in the way of a more general introduction of acetylene for illuminating purposes; since exceedingly complicated apparatus must be used to control the evolution of the gas, and, moreover, experience has shown that even these provisions do not always act with certainty. Instead of regulating the generation of the acetylene by mechanical means, attempts have often been made to do so by mixing with the water used to decompose the carbide substances which are not acted upon by the carbide; and, as will be known, methyl and amyl alcohol, acetone, glycerine, ether, and sugar

have already been proposed as such substances. Now, although the generation of the gas can be quite well regulated by mixing these substances with the reacting water, these proposals could not be carried out in practice, because it is too expensive."

The process according to this invention consists in using a substance which can "be provided in enormous quantities at small expense, because it occurs in a large industry as a most troublesome bye-product." This substance is chloride of calcium ($CaCl_2$), produced in the manufacture of ammonia soda by the Solvay process, and in other industries. The carbide is treated with a solution of calcium chloride in water; and the concentration of the solution depends on the quantity of gas that is to be generated in a given time from a given quantity of carbide. A solution having a specific gravity of 1·38 yields, for example, with 600 grammes of carbide, sufficient acetylene to supply a table lamp for a period of 29 hours. In this process, the carbide is always covered by liquid, and no variation in pressure can occur; while the same solution can always be used again, as it is only necessary to add from time to time a quantity of water corresponding to the amount of carbide added. When the calcium chloride solution is used for the first time, some of the lime produced by the decomposition of the carbide is dissolved and forms calcium oxychloride (basic calcium chloride).

Controlling the Supply of Gas to Burners and Effecting Ignition from a Distance.—Franzen, C., of Cologne. No. 635; Jan. 10, 1899.

In most electrical devices for controlling the gas supply to, and effecting the ignition and extinction of, gas-burners from a distance, separate electro-magnets have heretofore been needful; and consequently a double-circuit wire has been requisite for supplying the necessary currents. Furthermore, the devices for leading the current to the point of ignition are usually arranged outside the burner, which is liable to the disadvantage that the devices become injured, and with incandescent gas-burners the devices can easily injure the mantle when fitting on or removing the burner-head. Again, the point of ignition requires to be so near the hot zone of the incandescence body that the igniting bodies (whether platinum points for igniting by electric spark, or a platinum coil for igniting by incandescence) are liable to become deteriorated by the heat. The present invention relates to "an improved construction of such appliances, whereby these disadvantages are obviated."



In his specification, the patentee describes the invention in connection with the well-known electrical device for opening and closing the gas supply in which a rotatable disc having a series of peripheral holes receives a step-by-step rotary motion by means of a ratchet-wheel and pawl actuated by an electro-magnet, so that in one position of the disc a perforation is brought opposite the gas-supply passage, and admits gas to the burner, while in another position the solid part of the disc covers the passage and cuts off the gas supply. Applied to a Welsbach burner, the arrangement is as shown in the accompanying illustration—a vertical section with an igniter applied thereto, and part of the central tube (enlarged).

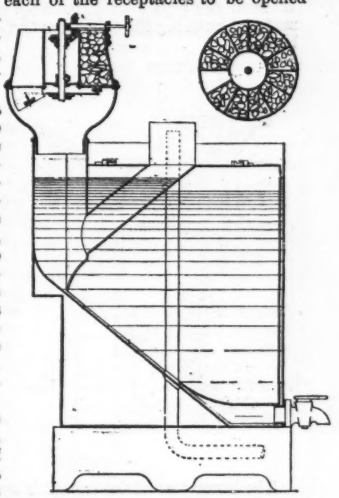
On the vertical stationary axis A of the electro-magnet appliance, on which a perforated disc is made to rotate, is fixed a small tube B that extends up within the tubular mixing-chamber of the burner (which may conveniently be carried on the top of the casing of the electrical appliance); and at a certain point within the chamber, it has fixed to its upper end a cylindrical head-piece C of insulating material, on the upper end of which is fixed a socket D of conducting material. The head C has a central passage, in which is fixed a small tube E of conducting material.

One lead of the electro-magnet M which works the perforated disc is passed up the tube B, and is fixed to the conducting tube E. The second lead is also passed up through the tube B, and through a lateral hole in the head C, and is fixed to the conducting socket D. Into this socket is (removably) fitted a short tube F of metal, which is thus in conducting contact with the socket D, and is suitably fixed on a small glass tube K extending up through, and to a certain distance above, the burner-head. Through this glass tube pass two conducting wires W, to the lower end of one of which is fixed the metal tube F surrounding the glass tube, while the lower end of the other wire is fixed to a metal conducting-pin G cemented into the glass tube. The pin fits into, and makes conducting contact with, the inner metal tube E, to which the one wire from the electro-magnet M is fixed. The upper ends of the two wires pass through the upper closed end of the glass tube, and have there fixed to them the two ends of a platinum loop or coil P extending up a certain distance above the burner-head.

By these connections of the lower and upper wires respectively with the conducting parts of the insulating head and the conducting parts of the glass tube that fit into it, a closed circuit is formed, extending from the winding of the one electro-magnet limb, up through the platinum wire loop or coil, and down again to the winding of the second limb. Thus, when a current is passed through the electro-magnet for actuating the perforated disc, it at the same time passes through the platinum loop or coil P, and, in heating it to incandescence, effects the ignition of the gas and air issuing through the burner.

Acetylene Generator.—Schneeweis, J., of Hanau-on-the-Main, Germany. No. 2392; Feb. 2, 1899.

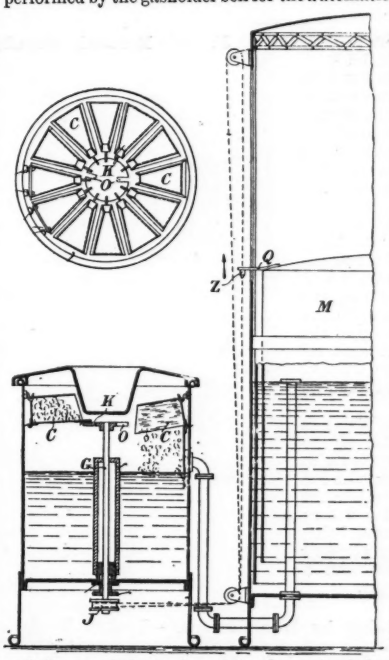
This invention relates to a generator of acetylene and an automatic distributor of the calcium carbide for use in connection therewith, consisting of a series of chambers circularly arranged (as shown) into which the carbide is introduced, and on being released drops into the generator by means of a rotating plate, which permits of the respective bottom plates closing each of the receptacles to be opened in succession—the plate being rotated by gear operated on the depression of a gasholder not shown, as it forms no part of the invention.



The generator is fitted with a rear-inclined bottom surface, to facilitate the falling of the carbide into the bell-shaped receiver within the casing, and having a perforated bottom plate for the reception of the lumps of carbide. The receiver is provided with a dome, from which the gas-pipe passes to the holder; and there is an inclined tube shoot (whose orifice is capable of being closed by means of a lid or stopper) serving the purpose of guiding the carbide into the receiver when filled by hand. For automatically feeding the carbide, there is a distributor consisting of a casing tightly fitted on to the side tube of the generator, made up of a circular series of compartments each closed by a bottom hinging plate provided at its edge with a roller and wedge-shaped guiding-piece. In the centre of the casing is a vertical spindle, at whose extremity a plate is mounted which has a circumferential slot, into which each of the hinging bottom plates falls ine succession on th slot of the plate passing into coincidence therewith.

Generating Acetylene.—Berger, H., of Berlin. No. 4223; Feb. 25, 1899.

The patentee claims that his generator provides for a certain quantity of carbide falling into the water, without it being previously exposed to aqueous vapour, and there is "the least possible amount of work to be performed by the gasholder bell for the automatic feeding of the apparatus."



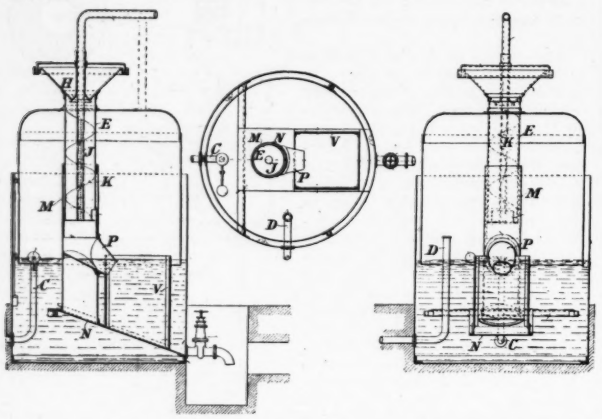
The generator (as shown) is half filled with water, and made gas-tight at the top by means of a cover. The carbide-holders C are composed of sheet-metal boxes, of circular segmental cross section, closed at the sides and top, and widened towards the bottom. The bottoms of the boxes consist of flaps pivoted on hinges, and having in the front pins soldered on; the holders being suspended on hooks fixed to the generator. In the middle of the generator is a vertical shaft G running through the bottom, and fitted with a stuffing-box and gland. It passes through a sleeve screwed to the stuffing-box, and terminates at the top in a disc K. This disc is provided with one or more slots O, so disposed that when the disc is partially turned, the pin of the case lying next the slot will fall through the slot, open the box, and allow carbide to drop into the water below. The cases being suspended from their upper rear ends on the generator and at a slight distance from the wall, when the pin falls through the slot of the disc, the box bumps down with its lower rear edge against the wall of the generator, and effectually shakes all the carbide out into the water.

The lower end of the spindle G, at the bottom, is provided with a fixed pulley J, round which a chain or cord engages; being guided on the gasholder, and carrying a stop Z capable of being adjusted to approximately the lowest position of the bell M. The bell is provided with a striker or fork Q which, when it sinks to approximately its lowest position, comes into contact with the stop on the cord or chain, and pushes it, and with it the cord or chain, down, and turns the pulley and partially rotates the disc so as to bring a slot under the pin of a fresh carbide receptacle and discharge it into the water of the generator.

Producing Acetylene.—Dauber, A., of Bochum, Germany. No. 17,343; Aug. 26, 1899.

In this arrangement of acetylene generator—vertical sections (at right angles to each other) and a cross section are shown on p. 32—the gasholder consists as usual of a fixed tank and a bell or moveable top. A water-pipe C with float regulates the admission of water and keeps it at a uniform level; while a discharge-pipe D allows the escape of the gas. The arrangement for admitting new raw material into the central part of the tank is as follows: A large tube E is fixed to the roof of the gasholder bell, and hangs down into it. At the bottom, it is closed; and at the top, it is provided with a feeding hopper covered by a lid, while below there is a cone H, to be raised and lowered to open or close the communication

from the feeding hopper to the lower part of the tube E. In the centre of the tube is arranged a perforated pipe J; and a spiral K is placed between the pipe J and the sides of the tube E, down which any raw material entering the tube from the hopper is guided to an opening at the bottom.

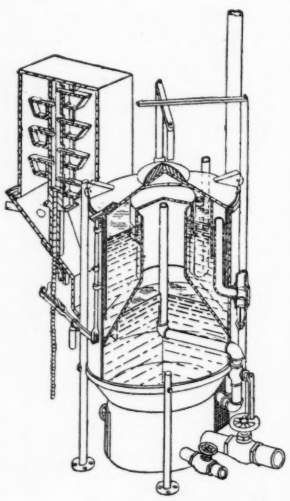


The lower part of the tube E is guided in a fixed tube M standing upon an oblique plate N, at the bottom part of the tank. About half way up (in the middle height of the tank) a spout or a funnel P is arranged in the tube M, forming an outlet sideways; and thus, when the bell with the feeding tube E has sunk so deep into the tank that this side opening arrives at the upper edge of the funnel and lower, the discharge of the material upon the spiral K into the funnel P begins.

The funnel discharges its contents into a small tank V placed upon the oblique plate N, and reaching up to the water-level in the apparatus. This has for its object to prevent the distribution of the carbide over the whole area of the bottom of the tank, so that no formation of gas can take place near the edges, where it could escape between the sides of the tank and the bell.

Acetylene Gas-Machines.—Matthews, F., of Montreal, Canada. No. 17,406; Aug. 28, 1899.

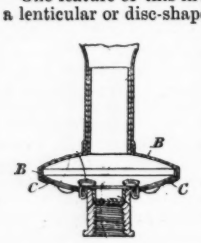
The object of this invention is to devise a compact and simple form of automatic machine for the manufacture of gas from carbide of calcium. It consists essentially (as shown) of a generator provided with a central hollow stem having connected to its four sides upsettable buckets to hold the carbide; the holding catch of the buckets being released by the head of a rod extending up through the stem and deriving an upward movement through the rise and fall of the gas in the holder, so as to upset the carbide in the bucket, or each set of buckets, in its turn into a shoot, which leads to a water receptacle underneath.

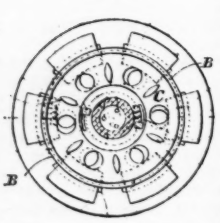


The generated gas thereby passes up a tube in the middle of the holder (which tube is provided with a safety air-pipe), so as to raise the dome in proportion to the amount of carbide deposited in the water; a blow-off pipe, of course, being provided to prevent any accident in the way of explosion from a mixture of air with the gas.

Burners for Gas-Lighting by Incandescence.—Voelker, W .L., of Sardinia Street, W.C., and the Voelker Incandescent Mantle, Limited, of Old Broad Street, E.C. No. 18,750; Sept. 16, 1899.

One feature of this invention consists in making the bunsen tube with a lenticular or disc-shaped chamber or enlargement near the lower end, and having in its lower or upper wall holes for the admission of air to the burner. By this means, the entering air impinges on the upper wall of the enlargement or chamber; and "the velocity of the air current ascending the smaller part of the bunsen tube is thus rendered approximately constant, notwithstanding external draughts or currents, and the flickering or disturbing effects of the latter on the light are consequently obviated or greatly reduced." Another feature of the invention consists in means for regulating the quantity of air and gas admitted to the burner. This is effected in the case of the air by arranging a perforated ring or annular valve to slide over the air-holes in the enlargement or chamber; so that, by turning the ring or valve, the admission of air can be regulated or controlled as desired. In the case of the gas, there is arranged in the inlet-jet a perforated diaphragm and a corresponding perforated disc to move over it—the apertures in the disc being preferably elongated and inclined relatively to a radius of the disc. Thus the area of the gas-inlet passages will be gradually increased or diminished (or closed) as the disc is turned in one or the other direction.





The illustration shows a side elevation (partly in vertical section) and an underside view (partly in transverse section) of an incandescent burner having these improvements applied to it.

In the upper end of the inlet-jet or nipple is mounted the bunsen tube, having at its lower end a lenticular enlargement or chamber B formed by two dished rings united to each other at their outer edges. In the lower wall of the chamber is formed a series of apertures, and on the underside is loosely mounted a ring C held in place by an inwardly-turned flange on the upper dished ring. The ring is provided with a series of apertures of similar size and pitch to those in the lower wall of the chamber B, and is formed with a series of projections whereby it can be readily turned about its axis. In the upper part of the inlet nipple is mounted a diaphragm having a number of apertures, and above is an adjustable disc having a series of apertures which are elongated and inclined relatively to a radius of the disc, so that, as the disc is turned in one or the other direction, the apertures will be gradually opened or closed. The disc and its apertures are (preferably) so arranged that the gas-way cannot be entirely interrupted—thus obviating the necessity of employing a separate bye-pass for a pilot-light.

These improvements are said to "render the burner more efficient than heretofore," and enables a bunsen tube to be used of smaller diameter than those generally employed.

APPLICATIONS FOR LETTERS PATENT.

25,114.—Melius, R. J., "Elevating and conveying coal and the like." Dec. 19.

25,138.—Dorman, D. M., "Acetylene gas-generators." Dec. 19.

25,164.—Schmidt, E., "Igniting devices for lighting gas and like lamps." Dec. 19.

25,171.—Abercrombie, J. H., and Symington, R. B., "Incandescent lighting mantles." Dec. 19.

25,197.—Rausch, J. H., "Lamps." Dec. 9.

25,229.—Meldrum, J. J., T. J., & J. W., "Furnaces." Dec. 20.

25,240.—Oldham, O., and Dack, W. N., "Separating water from gas or vapour." Dec. 20.

25,266.—Renault, L., "Explosion engines, and the utilization of the heat and products of combustion therefrom for the generation of gases or vapours." Dec. 20.

25,271.—Baker, F., "Means of illumination." A communication from C. Martin. Dec. 20.

25,332.—Wilson, J., "Gas-engines." Dec. 21.

25,359.—Duncan, J. H. H., and The New Sunlight Incandescent Company, Ltd., "Incandescence bodies for use with gas and like burners." Dec. 21.

25,374.—Robus, H. J., "Manufacture of coal gas." Dec. 21.

25,379.—Sharp, J., "Fluid meters, motors, and pumps." Dec. 22.

25,395.—Challen, W. B., "Unions for gas-pipes." Dec. 22.

25,443.—Marks, G. C., "Automatically operating a valve at any predetermined time." A communication from A. Stenhouse and E. A. Whitehead. Dec. 22.

25,465.—Alexander, T. W., "Pressure reducing and regulating devices." A communication from J. S. L. Alexander and A. G. Schoonmaker. Dec. 23.

25,492.—Nelson, W. O., Houghton, L. S., and Miller, E., "Acetylene gas-generator." Dec. 23.

25,503.—Quelch, G. H., and Kent, T. O., "Generation of acetylene gas." Dec. 23.

The Gas Supply of the Kingston-upon-Hull District.—The Gas Engineer of the Hull Corporation (Mr. F. J. Bancroft) reported to the Gas Committee on Wednesday that the output of gas from the Broadley Street works was being well maintained; and on the preceding Friday, the consumption had been 540,000 cubic feet, which was the greatest amount ever sent out from the works in one day. The plant will now be dismantled as soon as the connection with the British Gaslight Company's mains can be made. Reference to this matter was made in the course of the proceedings. Mr. Beautement inquired the reason of the delay in establishing the connection. The Chairman (Alderman Massey) replied that the explanation was simple. The N.E.R. Company said the Corporation's Act did not give them power to go under the Queen's Dock lock-pit. The Company had eventually to give way; but the wrangling with them cost the Committee about £500 for the renewal of the contract. It was also intimated that the pipe-laying contract would be finished by next April.

Fatal Accident at the Saltley (Birmingham) Gas-Works.—Thomas Price, aged 47, was killed last Tuesday evening at the Saltley Gas-Works of the Birmingham Corporation while shunting some coal and coke trucks. It appears that he signalled to the engine-driver to "come on." But in stepping clear of the rails, he stumbled and fell; and before the driver could stop, the wheels passed over him, severing the head from the body. Deceased had been engaged in shunting work for nine or ten years. At the Coroner's inquiry on Friday, it was stated by a witness that deceased gave the signal to the driver to move, and then started to get in front of the engine, in order to walk before it to see that the way was clear. This proceeding was described as a necessary one, and as being deceased's duty. There was no evidence to show how Price came to fall in front of the engine; but several witnesses stated that there was a stack of pipes at the side of the line, and two of them were very near the metals. One witness said the ends of the pipes were only 17 inches away; but Mr. Chaney, the Superintendent of the works, asserted that the nearest pipe was 3 ft. 2 in. from the rails. Jackson and the engine-driver said they had complained to the men who put them there, of the proximity of the pipes to the metals. The Coroner, in summing up, referred to the statement made by the driver as to the shunter walking before his engine, and said if this was a custom it was certainly one to which attention ought to be directed. The Jury returned a verdict of "Accidental death," but added a rider "that they thought there was culpable negligence in pipes lying so near." The Coroner drew Mr. Chaney's attention to the rider; and the latter said he could add nothing more to what he had said. No one, he pointed out, saw deceased stumble over the pipes.

PARLIAMENTARY INTELLIGENCE.

PROJECTED GAS LEGISLATION FOR THE METROPOLIS.

The Bills of the Gaslight and Coke Company and the London County Council.

In the "JOURNAL" for the 19th ult., we gave a full abstract of the Bill to be introduced into Parliament next session by the South Metropolitan Gas Company to enable them to alter the existing provisions as to the standard price and illuminating power of their gas, and to purchase by agreement the portion of the undertaking of the Gaslight and Coke Company on the south side of the Thames. The only other Bills relating to the supply of gas in the Metropolis are those promoted by the Gaslight and Coke Company and the London County Council. The general scope of these measures has been already indicated; but we are now able to notice them at greater length.

The Bill of the Gaslight and Coke Company is mainly a duplicate of the one which was unsuccessful last year. The preamble sets forth that by the Act obtained in 1898 the Company's debenture stocks were converted into one stock, called "3 per cent. consolidated debenture stock;" and that it is expedient that the Company should have further power to raise money by the creation and issue of £2,500,000 of debenture stock. The stock is to be offered by auction or tender, at a reserve price; and any premium resulting from the sale, after deduction of the expenses, is not to be considered as profits of the Company. The new issue is to be known as the "second 3 per cent. debenture stock." Unsold stock may be put up again at a subsequent sale, or be offered for tender under the previous conditions, and at a price equal to or above the reserve fixed. The Bill authorizes the Company to hold certain lands specified, and erect thereon works for the manufacture and storage of gas and the treatment of residual products; also to use other lands specified for any of their purposes except those named above. Power is sought to purchase by agreement further lands, not exceeding 150 acres, which may be required for the purposes of the undertaking, but not to be used for the manufacture of gas or residual products. A clause of the Bill specifies that the Company are not to be authorized to purchase or acquire ten or more houses which on the 15th ult. were occupied wholly or partially by persons belonging to the labouring class as tenants or lodgers, or, except with the consent of the Local Government Board, ten or more which were not so occupied at that date, but which have been or shall be occupied subsequently.

The Bill of the London County Council is for "making further provision as to testing the illuminating power of the gas" supplied by the Gaslight and Coke, Commercial, and South Metropolitan Companies in the Administrative County of London, and for "regulating the supply by those Companies of prepayment meters and fittings in connection therewith," and other purposes. The preamble sets forth the Acts which provide for the gas being of a certain illuminating power, and the arrangements made for testing it. It then goes on to say that it has been found that the illuminating power of the gas supplied by the Companies named in their districts generally "cannot be satisfactorily or sufficiently tested by tests made only at certain prescribed testing-places;" and that it is desirable that power should be given to the Gas Examiners to make additional tests elsewhere, in manner to be prescribed by the Gas Referees. Allusion is then made to the introduction of the system of supplying fittings and apparatus and selling gas by means of penny-in-the-slot meters at a charge which includes the price of gas and something additional for the meters and fittings; and it is stated that, as a consequence, the statutory provisions regulating the price of gas are in danger of being defeated. The Council consider that "the supply of such meters and fittings, and the charges therefor, should be regulated by the Board of Trade, and the amount of such charges stated to the persons who pay them, and that the Companies should keep and publish separate accounts of their receipts and expenditure in respect of such meters and fittings."

The Bill is divided into four parts, and there are 16 clauses. Part I. consists of the short title and interpretation clauses. Part II. relates to testing. Under clause 3, any gas examiner may make, at any place within the district supplied by any of the Companies, tests for ascertaining whether the illuminating power of the gas supplied by such Company at that particular place is such as is required by law. The apparatus to be employed in these tests, and the mode of conducting them and recording the results, are to be from time to time prescribed by the Gas Referees, who are to make regulations with respect to these matters, and send to the Council, the City Corporation, and each of the Companies a copy of the regulations. Clause 4 provides for the application of sections 11 to 14 and 17 to 20 of the Gaslight and Coke and other Gas Companies Acts Amendment Act, 1880, to the Act now applied for. Clause 5, relating to the notice to be given to a Company of the intention to test, runs as follows:—

> At least 24 hours before any test is made under this Act, the Council or the Corporation, as the case may be, shall give to the Company interested notice that tests are about to be made under this Act, specifying in such notice one of the testing-places prescribed and certified by the Gas Referees, and an hour at which it is proposed to start from such testing-place in order to make tests under this Act. No person shall disclose to such Company by such notice, or otherwise, the place at which any such tests are to be made. Any officer of such Company who may attend at the time and place specified in such notice shall be entitled to be present at the making of such tests, but shall not interfere therein. Any notice under this section may be sent by post.

Part III. of the Bill (clauses 6 to 15) relates to prepayment meters and fittings. It is specified in clause 6 that, as soon as may be after the passing of the Act, the Board of Trade shall, after holding an inquiry, approve a standard pattern or patterns of prepayment meters, and fittings for use in connection therewith, and shall fix, for the use of these meters and fittings by the consumer, such charges per 1000 cubic feet of gas supplied by means thereof as they may think reasonable, having regard to the fair and proper cost of supplying such appliances. By the next clause, the Board of Trade are to send to each of the Companies, to the Council, and to the Corporation, a statement showing the approved standard patterns, and the charges fixed. Specimens of meters and fittings of such standard patterns, or of such parts thereof as the Board of Trade may appoint, are to be kept at the Board of Trade, and at the offices of each of the Companies, the Council, and the Corporation, and are to be open to public inspection at all reasonable times. Clause 8 sets forth that, within two months from the receipt of the statement above referred to, the Companies are to furnish to each of their consumers supplied with gas by means of a prepayment meter, a statement, in a form to be approved by the Board of Trade, setting out the charges fixed by the Board for standard fittings, the places at which the specimens are to be seen, and the conditions under which persons are entitled to be supplied therewith.

Under the next clause, any person who is entitled, in respect of the ownership or occupation of any premises, to be supplied with gas by any of the Companies may, by notice in writing specifying the premises, require the Company to supply thereon standard fittings; and they shall, within a reasonable time, supply the same accordingly, and shall keep in repair and renew them when necessary. If the applicant requires the Company to supply standard fittings on any premises on which there are, in working order and repair, similar fittings already supplied by the Company, the latter are not to be bound to supply them until the applicant shall have paid to them the reasonable expenses of replacing, either by substitution or alteration, the fittings already on the premises by standard fittings. Any question as to the amount of such payment is to be decided by a Court of Summary Jurisdiction.

The next three clauses (10 to 12) relate to the charges to be made for the fittings. Under clause 10, it is not to be lawful for any of the Companies to charge, or for a consumer to agree to pay, for the supply of gas by means of standard fittings, a greater sum per 1000 cubic feet than the price which the Company may be by law entitled to charge for gas, together with the charges for the use of such fittings fixed by the Board of Trade. After the issue by the Board of a statement showing the standard patterns approved and the charges fixed, no agreement entered into by any Company with any person for the supply to him of gas by means of a prepayment meter otherwise than by standard fittings shall be valid, unless and until the Company shall have handed to such person a copy of the Board's statement, and unless such agreement shall be in writing, and shall expressly specify that such person does not desire to be supplied with gas by means of standard fittings. Receipts are to be given for moneys received from any consumer supplied with gas by means of a prepayment meter; and every such receipt is to contain a statement showing clearly the charge for gas per 1000 cubic feet and the charges fixed by the Board of Trade for standard fittings. The Companies are to keep, in a form to be approved by the Board of Trade, a separate account showing all expenditure and receipts in respect of prepayment meters and fittings, and furnish to the Council and the Corporation copies of such account with their annual statement of accounts. Except as otherwise provided, these separate accounts are to be subject in all respects to the statutory provisions relating to the general accounts of the Companies respectively. Each of the Companies shall, in each half year, carry from the separate account to a renewals account such sum as the Auditor appointed by the Board of Trade to audit the accounts of such Company shall direct; and the money standing to the credit of such renewals account is to be applied solely in providing for renewals of such meters and fittings.

Clauses 13 and 14 provide for the revision of the standards and charges. If at any time after the expiration of five years from the date of an inquiry under the Act, any of the Companies, the Council, or the Corporation request the Board of Trade in writing to revise the patterns or the charges approved and fixed, the Board are to hold a fresh inquiry, and they may, if they think fit, make any alterations in the patterns or charges. It is provided that the Board may at any time, if they think fit, at such request, hold such inquiry and make such alterations as aforesaid. At least 28 days before holding any inquiry, the Board of Trade are to give to each of the Companies, to the Council, and to the Corporation notice of the time and place thereof, and the Companies, the Council, and the Corporation are to be entitled to attend and to be heard thereat.

Clause 15 specifies that the penalty for any breach of the provisions of the Act is not to exceed £5; and for any continuing breach, not to exceed £5 for every day during which such goes on. The penalties are to be recovered, applied, and apportioned as if they were penalties under the Metropolis Gas Act, 1860.

Part IV. consists of one clause (16), which provides for the costs, charges, and expenses incidental to the passing of the Act being defrayed as payments for general county purposes within the meaning of the Local Government Act, 1888.

THE PROVISION OF ADDITIONAL STORAGE RESERVOIRS IN THE THAMES VALLEY.

The Bill promoted by the London Water Companies with the object of conferring upon the Local Government Board power to call upon them to submit schemes for additional storage reservoirs in the Thames Valley, to which reference has already been made in the "JOURNAL," has been deposited, and the following is an abstract of its provisions.

The preamble sets forth that Lord Balfour's Commission, in their report, expressed the opinion that in the year 1931 the population of the area served by the London Water Companies would be upwards of 11 millions, and that the needs of this increased population would be met by the construction of storage reservoirs in the Thames Valley at no great distance above the intakes of the Companies. It then refers to the authority given to the Staines Reservoirs Joint Committee and the Southwark and Vauxhall Water Company to make reservoirs (the former being, in fact, an instalment of the scheme recommended by the Commission), and to the Companies to effect intercommunication between their systems, and carry out such works as might be necessary to enable them to supply each other with water. It goes on to state that "for the purpose of giving more complete effect to the opinion and recommendations of the Commissioners, it is expedient that further powers be conferred upon the Local Government Board with a view to the providing, by means of additional storage reservoirs in the Thames Valley, for

the supply of water in the future within the districts of the Metropolitan Water Companies, and that the obligation be imposed upon the Companies of giving effect to any requisitions of the Local Government Board in that behalf."

Clause 1 of the Bill simply gives the short title—the "Metropolitan Water Companies Act, 1900." Clause 2 confers upon the Local Government Board power to require the Water Companies to submit schemes for making the reservoirs above referred to; and the Companies are to submit them accordingly. Clause 3 provides that when the Companies have complied with the Board's request, an inquiry is to be held on the scheme by one of the Inspectors; and the next clause charges the Companies with the costs. Under clause 5, the Local Government Board may make such order, upon the report of the Inspector, as they may think fit, requiring the Companies to carry out the works specified in the scheme; and the Companies are to comply with the order, and, if necessary, apply to Parliament for further powers to enable them to do so. Clause 6 empowers them to take any lands, &c., specified in the order; and the following one prohibits the acquisition of 10 or more houses occupied by persons of the labouring class, unless some scheme prepared by the Companies for providing new dwellings has obtained the sanction of the Local Government Board. Clause 8 makes section 12 of the Water-Works Clauses Act, 1847, applicable to the new works to be constructed. Clause 9 is as follows:—

For the purpose of filling with water any reservoir which may be constructed by any Company or Companies as aforesaid, such Company or Companies may, with the sanction of the Local Government Board in writing, and with the consent in writing of the Conservators of the River Thames, take further water from the River Thames and its tributaries, at such times and places, but at such times and places only, as the Local Government Board specify in that behalf as being, in their opinion, times and places at which such water may be taken without injury to the River Thames, and without prejudice to the rights of any Companies or persons empowered by statute to take water from the river, or to the rights of any third parties.

Under clauses 10 and 11, the Companies may agree for the joint exercise of the powers conferred by the Act and the apportionment of the water to be obtained under it; and any one or more of them may purchase lands by agreement. Clause 12 sanctions the raising of the necessary money by the issue of debenture stock, which is not to be subject to the sinking fund. The remaining clauses (13 to 16) specify that any Company failing to comply with an order will be liable to a penalty of £100 a day, or any less sum which the Court may adjudge; that the expression "Metropolitan Water Companies" means those mentioned in section 3 of the Metropolis Water Act, 1871, and that "Thames Valley" means and includes the basin of the River Thames between Molesey and Lechlade, and the basins of all rivers and streams falling into the Thames between those places; that the Companies are not to be exempt from the provisions of the General Acts relating to the supply of water to the Metropolis now or hereafter to be in force; and that the costs incidental to the passing of the Act are to be borne by the Companies.

LEGAL INTELLIGENCE.

Emanations from Gas Residuals Works in Manchester.

Last Thursday week, the Manchester Stipendiary (Mr. F. J. Headlam) gave his decision at the City Police Court, in the matter of two summonses taken out by the Corporation against Messrs. Hamor Lockwood and Co., and Messrs. Hardman and Holden, chemical manufacturers at Miles Platting, in respect of a nuisance alleged to have been caused by the emission of noxious fumes from the gas-residuals works of the defendants. The summonses had formed the subject of a protracted investigation at the Police Court. Mr. Headlam said he understood the difficulty there had been in ascertaining definitely where the nuisance arose; the works of the two defendants being in close proximity to each other. He was of opinion, however, that the evidence exonerated Messrs. Hardman and Holden; and the summons against them would be dismissed. He was further of opinion, after considering the evidence, that the smells arose from the works of Messrs. Hamor Lockwood and Co.; the evidence offered on their behalf as to the manner in which they carried on their business not being so satisfactory. They would, therefore, be fined £5 and costs in two cases.

The Deficiency of Electric Lighting in Marylebone.

At the Marylebone Police Court last Friday, the Metropolitan Electric Supply Company, Limited, of Baker Street, appeared in answer to summonses, taken out by the Guardians of Marylebone and the Marylebone Vestry, for making default in supplying electrical energy to the Workhouse and the Vestry premises on the 7th, 9th, 11th, 12th, and 14th ult. Mr. Herbert Manisty supported the summonses; and Mr. Muir represented the defendants. Mr. Fenwick informed the Court that he was present on behalf of 33 persons living in Great Portland Street who wished to take action against the Company. Mr. Muir said the Company admitted the default, but it was owing to an unavoidable accident. That the demands made upon them had exceeded their most sanguine expectations would be seen when he stated that, whereas the number of lamps supplied in 1892 was 78,000, in 1897 it had risen to 187,000. There had been an unprecedented augmentation since 1897 in the number of lamps; the increase being 20 per cent., or 80,000 lamps, in addition to what they had already to provide for. The Company desired to acknowledge the forbearance and courtesy received from their customers during this trying period. The object of the prosecution being to ensure the fulfilment of the Company's contract, he hoped the Magistrate would not inflict any penalty at this period, but would adjourn the summonses till after the dark days had passed. Mr. Plowden said it seemed to be clear that when the Company started they never contemplated their future greatness; and when this fact became apparent, they made frantic and praiseworthy efforts to meet the emergency—efforts, however, which had not been a complete success. The cases were adjourned for three months.

MISCELLANEOUS NEWS.

THE ROYAL AQUARIUM GAS EXHIBITION.

Not for the first time, the Royal Aquarium has lent its aid in demonstrating progress in artificial lighting by means of gas. If we remember rightly, it was in one of the galleries of this place of pleasure that the Denayrouze burner made its *début* in this country; and now the authorities have given up a large portion of their ground space to one of the finest collections of modern gas lighting methods that has been brought together during recent years—thanks in the main to the active organization of Mr. M. J. G. Ritchie and Mr. T. G. S. Hersey. Gas cooking and heating, and even the realm of the gas-plant manufacturer, are not altogether neglected; but gas lighting predominates. On entering, one is met with a perfect effulgence in the body of the building, at either end of which are congregated most of the principal stands. Altogether there are upwards of forty stands, and the major part of them are centres of light—both coal gas and acetylene; and as some of the exhibitors have done their best to out-shine their neighbours, the great light here and there is almost dazzling, if not bewildering. Looking round generally, one is struck by the fact that progress and present-day requirements have almost entirely shut out some of the old friends of the gas industry. Where now, for instance, are the many types of flat-flame burners and recuperative and regenerative lamps that held sway at the time of the great exhibition at the Crystal Palace? The present exhibition supplies the answer. On every side, whichever way he turns, the visitor is met by the incandescent gas-light, and the many novelties and accessories which the makers of gas-fittings have introduced in connection therewith. Competition and the demand for a stronger light have produced these things; and slowly but surely the old forms of lighting are falling before them. The exhibition is to remain open until the 23rd inst.; and no doubt many gas engineers and managers will take this opportunity of inspecting under favourable conditions this aggregation of lighting systems. No good purpose would be served by noticing in detail here all that is to be seen; but we give a general indication of the character of the articles on view, with special mention of some of the striking features.

As near as it is convenient to do so, we shall follow the order of the stands as set forth in the catalogue. Adopting this course, we have first to deal with what is called "Area, East Section." Stand 1 comprises a collection of high-power and street-lamps on the incandescent system, furnished by the Welsbach Company, and situated in the Abbey entrance to the building. Here are seven large burners supplied with gas at 8 inches pressure by means of Keith's apparatus; the increased pressure raising the illuminating power from 100 to 240 candles per burner, with a consumption of only 8 cubic feet of gas per hour. For convenience only, in this particular instance, the Keith apparatus is operated by a small gas-motor; but if water was employed in the usual way, we are assured about 2 gallons per hour would suffice for the purpose, which speaks well for its economical efficiency. A variety of the Welsbach Company's street-lamps are also on view; but the most attractive feature of this section of their exhibit is an illustration of the adaptation of their system to lighthouses. The honour of being prime mover in this direction is due to Mr. H. Matthews, the Engineer-in-Chief to the Trinity Board; and the dioptric apparatus on view has been kindly lent by the Elder Brethren of the Board. Already the light has been applied to two or three lighthouses on the coast; and the section of lenses on view comes from the one at Lowestoft Low. These lenses multiply the light seven or eight times; so that as the lamp contains seven mantles, each giving a light of 240-candle power, a magnificent illuminating power is arrived at, as will be found by working out this little sum: 240 candles × 7 × 8. A short distance away the light has the appearance of a large incandescent pillar. There seems to be no reason why the incandescent system should not be generally adopted for lighthouse purposes where a supply of compressed gas can be provided. Stand 8 is also furnished by the Welsbach Company. The structure makes a beautiful centre-piece in this section of the exhibition. It is about 25 feet high, and has a dome-shaped roof, surmounted by a huge model of a Kern burner, giving a light of 3500-candle power. Probably by this time a large opal reflecting screen has been raised above the burner; and we can imagine that with this arrangement there will be a perfect flood of light from this source. The body of the stand is covered by multifarious fittings of chaste and exquisite design, bearing the various forms of Kern burners and mantles. Tasteful shades and globes of divers shapes and hues all assist in making up a very pretty stand. Among the globes is one which has been specially designed for use with the Kern burner, in order to ensure a downward radiation of the rays—a small improvement with an important effect. The Matchless bye-pass lighters as applied to the Welsbach burners are also exhibited, in order to give visitors an opportunity of testing their utility. A further display is made by the same Company at stand No. 43 in the south gallery; and much that has been said about stand 8 applies also to this. Among the numerous attractions will be observed the improved Frédureau gas projector for street lighting, and the "Simplicitas" gas-fittings for domestic lighting. There are several choice designs of these patent fittings; and they certainly possess noteworthy advantages. There is no brasswork above the chimney to get discoloured by the gas-fumes, the globes are easily removed for cleaning, the artistic effect and graceful outline of electrical fittings is attained in combination with the practical advantages and economy of incandescent gas lighting, and the position of the burner is such as to give the greatest illumination where the light is wanted. Altogether it may be said the Welsbach Company make a very successful display.

At stand 2 Messrs. Worsnop and Co., Limited, of Halifax, have an exhibit of new acetyloid lamps for domestic and other uses. Mr. L. Wiener occupies stands 3 and 30 with steatite acetylene burners and gas and electric light fittings; and on stand 4, Mr. C. Maynard Walker presents samples of his water-heaters, heating-stoves, anti-shock attachment for incandescent mantles, and gas fittings and lamps. The Davis Gas-Stove Company, Limited, are in possession of stand 5, which is not given the prominence that such an old-established firm should have commanded. However, they have made the best use of their space. Two noble-looking exhibits are an automatic hot-plate for employment in large

institutions, and a double oven roaster for hotel use. The famous "Metropolitan" gas kitcheners, of course, bulk largely; and a collection of other domestic and trade gas appliances make up a very presentable display. Stand 6 was allotted to the Voelker Mantle, Limited; and their preparations promised a very gorgeous display. But presumably through the intervention of the arm of the law (in the form of an injunction issued on the petition of the Welsbach Company), the work has been stopped. Workmen, however, were again busy there at the end of last week; but to what use the stand is now to be put we do not at present know. On stand 7, the Acetylene Illuminating Company have a number of photographs illustrating their system of lighting. Acetylene apparatus is shown on stands 9 and 10 respectively by the F. Dye Heating Company and the Husson's Safety Acetylene Syndicate. Attention is next arrested by the exhibits of the combined firms of Thomas Glover and Co., Limited, and R. & A. Main and Co., Limited, at stand 11. Numerous examples of the well-known meters of the first-named firm are shown; and the meter which took several prizes for them at the great exhibitions of several years ago is to be seen encased in glass. A prepayment meter is also open for inspection; and an old friend is once more to the front in the shape of the model of the 3000-light dry meter which was used at the Crystal Palace in Hyde Park in 1851, to measure all the gas used in that building. A test-holder, gauges, and several other of the goods of the firm are also on view. Messrs. R. & A. Main and Co. have supplied a splendid collection of their gas cookers, which contain certain new features enhancing their usefulness and economy. In addition to the gas-fires and other goods, visitors will be interested in the complete installation of a prepayment supply. Stand 28 (in the small concert hall) is also in the occupation of this firm; and among the manufactures on view there is an 8-feet steam hot closet. In conjunction with the firm's exhibits, Miss Blanche Cameron lectures twice daily. Passing the Buffington Acetylene Gas-Light Company's attractive display, we come to stand 13, at which Messrs. Wright and Butler, Limited, of Birmingham, make their first bow to the public as manufacturers of gas heating and cooking stoves. This firm were originally oil-stove makers, but have now put down a foundry and shops for turning out gas-stoves of high-class finish and workmanship. They have a good assortment of fires and stoves of various types, some of which are quite artistic in appearance. The aim of the firm is evidently to produce goods which, while giving satisfaction in use, shall have a pleasing exterior. Messrs. S. Clark and Co.'s "Syphon" stoves, which occupy stand 14, are too well known to require any lengthened reference. Turr's Acetylene Gas Syndicate, Limited, have an interesting exhibit of acetylene generators and appliances on stand 15; and they are followed (stand 16) by Messrs. Falk, Stadelmann, and Co., Limited, who have brought together a choice collection of their newest and most improved designs in gas-fittings, and acetylene burners, lanterns, and fittings. Further acetylene apparatus is found on stand 17; the exhibitors being Messrs. Thorn and Hoddle.

Passing now to what has been named the "Area, West Section," the first stand demanding attention (No. 18) is that of the Hydro-Incandescent Gas-Light Company, whose principal object of interest is the new Scott-Snell gas-compressor, which has been incorporated in their system of high-power lighting, and for which the Company claim several excellent qualities. A more extended notice of this machine is given elsewhere; but it may here be mentioned that the one on view (which is astonishingly small for the work performed) is in operation, and is employed in raising the pressure of the gas for the lights illuminating the southern gallery, the stand itself, and St. Stephen's Hall (west entrance)—in all some sixteen 500-candle power lamps. With a pressure of 30 inches off the water-main, this small instrument imparts a pressure to the gas of about 54 inches; and every facility is given for testing on the spot the truth of the statements made. The machine, which works smoothly and silently, is worthy of the inspection of the professional visitor. Plans showing the adaptability of the system to any purpose from docks to drawing-rooms may be inspected. On the same stand are also seen samples of the patent "Economy" gas-cooking stoves and hot-plates. These, which are of German origin, are fitted with specially constructed bunsen burners, giving a splendid heat, with a moderate gas consumption. The hot-plates are closed in all round like a cooking-range; and in this way the heat is retained to such an extent that several pans may be kept practically boiling, with (say) only one burner alight. Further exhibits of the Hydro-Incandescent Company will be found on stands 36 and 38 in the southern gallery. The Incandescent Accessories and Maintenance Syndicate make a very respectable show at stand 19. The speciality of this firm is the maintenance of incandescent lights; but at the stand the most interesting exhibit is an anti-vibration burner, to which a gold medal was awarded at the Leicester Industrial Exhibition in October last. Hard by, on stand 20, Messrs. Samuel Cutler and Sons make a display of several clear and well-finished photographs of gasholders completed and in course of erection, and also of apparatus for the manufacture of coal gas and carburetted water gas. Stand 21 is engaged in displaying a light refracting and diffusing "envelope" for electric incandescent lamps, which is also applicable to gas lighting. The exhibitors are the Spiral Globe, Limited. The Acetylithe Light Syndicate show special generators and apparatus using "acetylithe"—a form of prepared carbide. This is the system known in France as the Letang-Serpollet.

We now come to a set of exhibits which will be found extremely interesting to the gas-works engineer. They are supplied by West's Gas Improvement Company, Limited, and are disposed on stand 25. One of the first things to claim attention is a splendid and powerful coal-breaker, fitted with a double pair of claws, and slide-door complete. By its side stands a vertical 8-horse power engine to drive it. In erecting these coal-breakers for use, the manufacturers prefer to place the engine in a separate building, connecting up through the partition wall. The initial expense of this division of the plant is perhaps a little more than would otherwise be the case; but it is soon counterbalanced by the saving in wear and tear. These machines certainly look capable of any amount of hard work. There is also on view a 4½-inch double-cylinder compressed-air motor, designed for driving West's compressed-air charging-machines; but it can also be employed for hauling coal trucks and waggons on gas-works. A smaller pattern (3¾ inch) such as is used for operating the drawing-machines, is also shown. Careful workmanship is betokened by the nice adjustment and finish of these motors; and expert tests accord to them a very high degree of efficiency. There is also to be seen a model of the firm's new patent coke-conveyor, with Hunt's patent roller chain, for which West's Improvement Company are the sole agents. Another object of interest is a model of a section of a retort-house fitted with West's manual charging and drawing machines and elevator complete. On the screen at the back of the stand are a number of photographs and pictures illustrating the Company's labour-saving appliances for gas-works and their various shops at the Miles Platting works. Several, if not all, of these photographs, and some splendidly executed original drawings, were the work of an old servant of the firm—Mr. R. J. H. Sayers.

We now come to the exhibit of the New Sunlight Incandescent Company, Limited (No. 26), who have supplied, by the ingenious arrangement of their stand, one of the attractions of the exhibition. Around an old fountain they have constructed what, a little distance away, appears to be a veritable temple of light; and it occupies in this area a corresponding position to stand No. 8 of the Welsbach Company in the east section. By means of a number of gas-pipes, a circular body with domed roof is delineated. Closely placed over this framework are the different types of the Company's burners and mantles, all alight; and the whole is surmounted by three clusters of high-power burners—the entire arrangement forming quite a brilliant spectacle. Of course, prominence is given to the Company's "Simplex" burners and white mantles; and they may be seen in use without chimneys, or ensconced in very prettily designed bulbs and globes. It will be observed that the "Simplex" burners are constructed in three sizes, suitable (No. 2) for cottage lighting, (No. 3) for shop and interior lighting, and (No. 4) for street lighting, and that they are supplied with an ornamental attachment, which gives them a very sightly appearance for interior use. We understand that the No. 4 burner is being largely adopted for street lighting, and that it gives a duty of something like 100 candles per 4 cubic feet of gas consumed, without any artificial means. Concerning the mantles, attention is called to the double supporting threads at the top, which is a further protection against collapse—dividing as it does the responsibility for the safe upholding of the mantle. We are also informed that the companies who cater for high-power illumination show a decided preference for Sunlight mantles owing to their durability. On this point of strength and lasting power, the Company are naturally elated over the results of some comparative tests made by Mr. C. R. Bellamy, the Corporation Lighting Superintendent of Liverpool, and which are referred to in a letter by the Chairman of the Company in alluding to an interview he had with Mr. Bellamy. An extract from the letter has been handed to us; and it may be conveniently quoted here. It reads: "Mr. Bellamy showed me a very interesting table of curves yesterday, showing the Welsbach mantles starting at about 27 candles per foot (with their rich gas this is possible), but coming down steadily and rapidly to about 12 candles per foot, and giving out at about 700 to 1000 hours; whereas our mantle, starting at about 14 candles, went up to between 15 and 16, and then kept almost a dead-level right across the paper to 2800 hours, and he had a note from his assistant saying that it had done now 3100 hours without any show of loss in efficiency. The effect on the table of the curves was very striking; but my attention was, of course, arrested by the fact that, with his specially rich gas, he got but little over 15 or 16 candles. It then transpired that these were tested over a governor which reduced the pressure to about 7-10ths. I have no doubt that this was the result of our comparatively low showing." Returning to the Company's exhibit, a goodly collection of effectively designed gas-lamps, pendants, brackets, and fittings of all kinds suitable for incandescent lighting are arranged for close inspection here and on stands 26a and 39—the latter being in the south gallery.

Gas-engines occupy the next three stands to be noticed. On the first (No. 27), Messrs. Crossley Bros., Limited, show a fine example of their type "O" high-speed electric-lighting engine, fitted with extra heavy fly-wheel supported by outside bearing. This engine is specially arranged for electric lighting direct from the dynamo, and is capable of giving an effective constant load of 12-horse power at the normal speed. The engine on view is used for driving a dynamo for lighting the stand. Messrs. Bilbie, Hobson, and Co. (the London representatives of Messrs. J. E. H. Andrews and Co., Limited) exhibit one of the modern type "Stockport" engines (8 brake horse power), fitted with two fly-wheels, and all the latest improvements, which may be critically inspected. A useful little engine is shown by Messrs. Lawton and Parker. It is of ¼-horse power and 1-horse on the brake. It is equal to supplying current for ten 18-candle power electric lamps. The claims for it are that it is simple in construction, effective in operation, and withal cheap. Of course, other sized engines are supplied by the firm.

On stand 31, Mr. Strauss Collin exhibit the electric and pneumatic arrangements for lighting and extinguishing gas lamps, jets, and mantles at any desired distance, as described in the "Journal" for Oct. 10 last (p. 876). They may be inspected and tested, fitted to domestic lights and street-lamps; and the ingenious piece of mechanism which is the centre of the whole operation is open to examination and explanation. In regard to the use of this device for public lighting, we are told that the street lamps of Metz have been fitted with it, with very satisfactory results. In the case of the lamps containing double incandescent burners, the fittings have been so arranged that one burner in each lamp may be extinguished at any given hour; the other remaining alight. The experience at Metz, it is stated, has proved that distance does not affect the effectual operation of the contrivance. Close by, on stand 33, Mr. J. W. Wilson exhibits a cheap form of incandescent burner, which he can supply at the modest price of 1s. The stem is tapered so that it can be used on any ordinary fitting. The gas-inlet is very minute compared with the mixing-chamber above; and the proportion of air to gas used is fixed at 5 to 1—the consumption of gas being about 2¾ cubic feet per hour. Above the gauze top of the burner, a small disc is provided, for the purpose of directing the flame fully on to the mantle. On the next stand, Messrs. Defries and Sons, Limited, exhibit their patent differential gas regulators and economizers, chandeliers, brackets, standards, illumination devices, &c.

In the north-west gallery, a suite of rooms is being sumptuously fitted up for demonstrating the effectiveness in ordinary use of the Denayrouze system and the Ærogene gas-light (Van Vriesland's patent). This latter is said to be a cheap method of lighting country villages and private houses where coal gas is not obtainable. The Van Vriesland

compressor for use as a pressure augmenter for ordinary gas is also to be shown. It is claimed to be the simplest and most efficient system for the purpose named. At the end of last week, the installation was not quite complete; but probably by this time it is ready for inspection. A great deal of expense has been incurred in making this a very attractive exhibit, and worthy of a visit.

In the south gallery, there are a few stands; but, beyond those already noticed, there is only one to which reference need be made, and that is No. 41. It is in the occupation of Messrs. Thorpe and Salter, who are showing the "Ruby" gas-engines for driving coffee mills, dynamos, and small pumps. The gas consumption is said to be only 5 cubic feet per hour, including the burner for tube.

This completes our notice of the exhibition; and sufficient has been stated to show that the exhibitors have done their best with the space placed at their command, and have brought together a good collection of some of the best results of recent invention. These are the things which have done much to give a fresh spurt to progress and development in the industry with which the "JOURNAL" is identified, and which promises, in spite of electrical competition, to grow in strength as the years roll on.

FATAL EXPLOSION AT THE DOUGLAS GAS-WORKS.

Three Lives Lost.

Shortly after five o'clock in the afternoon of Friday, the 22nd ult., three serious explosions, unfortunately attended by fatal results, occurred at the Douglas (Isle of Man) Gas-Works. It should be explained that when the works were reconstructed some years ago, two gasholders, which occupied a position close to the boundary wall, were taken down, and a larger one was erected on a different site. The tanks, however, about 40 feet in diameter and 14 feet deep, were left, and afterwards covered with a brick-work and concrete roof, supported on pillars and girders, and provided with manholes, and used as receptacles for tar and liquor. Close to the liquor-tank stood the washer and tower scrubber; and beyond the tar-tank was the sulphate-house. In front of the two tanks stood the engine and exhauster house and the stores, with the condensers and purifiers at one end; and beyond this building was the retort-house. At the time mentioned above, two workmen, named Coole and Baird, in the employ of Messrs. Knox and Son, Engineers, of Douglas, assisted by James Mudie, one of the Gas Company's servants, were engaged in fitting up a new pump for the liquor-tank; and it is surmised that, contrary to the rules of the Company, they used a naked light. While they were at work a violent explosion occurred in the liquor-tank; blowing off the roof, and fracturing a main lying above it, which conveyed the gas from the scrubber to the purifiers, liberating the gas, which immediately took fire. A few minutes later, the washer blew up, and then the scrubber. Consternation prevailed in the town as well as on the works. On recovering from the first effects of the shock, prompt measures were taken by shutting off the gas from the holders and opening the retort-lids, to reduce the tremendous blaze. In these operations, great bravery was displayed by all the men on the works. When the flames were at length extinguished, it was discovered that three men were missing. Coole was discovered grasping one of the pillars which had supported the roof of the tank. At this moment an act of splendid heroism was performed by James Boyde, one of the workmen, who made a desperate attempt to reach Coole, but failed, and both men fell into the liquor. Boyde managed, however, to secure him to a rope, which was round his waist, and they were then drawn up. On reaching the surface, Coole was found to be dead, and Boyde's bravery would have cost him his life had not doctors been in attendance to properly treat him, for he was for some time thought to be dying. The other two men—Baird and Mudie—were still missing; and it was considered to be impossible that they could be found alive. It was then decided to empty the tank; and a steam-pump was promptly set to work for the purpose. Baird's body was recovered early the following morning; but it was not until last Tuesday morning that Mudie was found beneath a mass of tar and *débris*. The interruption in the supply of gas which resulted from the explosion necessarily caused great inconvenience in the town; the shop-keepers being busy in view of Christmas. But the Secretary and Manager of the Company (Mr. C. H. Kay) set about repairing the damage as quickly as possible; and, by making a temporary connection between the condensers and the purifiers which had not been damaged, he was able to resume gas making by Saturday night, and to send out what, under the circumstances, was a very good supply of gas. In some portions of the town, however, there was none until Sunday evening. In the meantime, Mr. T. Newbigging, the Company's Consulting Engineer, who designed the principal portions of the works, was telegraphed for. On reaching Douglas he at once proceeded to the works, and expressed satisfaction with the measures which had been taken to restore the supply.

An inquiry into the circumstances attending the catastrophe was opened by the High Bailiff of Douglas and a Jury on the 23rd ult.; but only formal evidence of identification was given, and the scene of the accident visited. The proceedings were resumed last Wednesday, when Mr. Newbigging was the principal witness. He said the construction of the liquor-tank, where the explosion took place, was similar to that of the tanks at many other gas-works; but, in his opinion, it would have been better to have ventilated it by means of a shaft instead of manholes. The tanks were the only portion of the plant and works which had not been erected under his advice; if they had been, he would have advised ventilation shafts. The explosion, in his opinion, was caused by a naked light having come in contact with hydrocarbon gases issuing from the tank; but the light must have been about a foot from the manhole. Mr. Kay stated that verbal instructions had been given to the men not to smoke or carry lights near the tanks. The deceased man Mudie was yard foreman, and knew about the danger. Alfred Hughes, an apprentice working with the three deceased men, but who had been sent away on a message when the explosion occurred, deposed that a naked light had been used both then and on the previous day. Mudie held the light while Baird was working. The inquest was then adjourned till the following day, when Thomas Moore, clerk at the weighing office, said he had warned the lad Hughes not to take a naked light to the tar-yard. James Christian said there were only two closed lamps on the premises—one being in the engine-house and the other in the sulphate-house. The Coroner, in summing up, commented on the careless use of lights and the improper ventilation of the tank. He expressed the hope that the Gas Company would provide for the widows and orphans of the dead men. The Jury, in their verdict, said that the explosion was due to the careless use of a naked light, which had been used to the knowledge of Mudie, the yard foreman. They recommended that the ammonia-tank should be ventilated by air-shafts, and that notices should be posted up giving a warning against using lights in dangerous parts of the works. Safety lamps should also be provided. For the Company, an undertaking was given that the recommendations would be complied with.

A subscription has been started in Douglas for the benefit of the widows and children of the unfortunate victims of the disaster.

THE DISPUTE WITH GLASGOW CORPORATION GAS WORKERS.

The Corporation and the Proposed Conciliation Board.

The campaign by the Trade Union interest against the right of the Corporation of Glasgow to deal with their own workmen proceeds slowly. The leading event of the week before Christmas was the reception, on the 21st ult., of the deputation appointed at the public meeting held on the previous Thursday to lay before the Town Council the views of the "new men of peace." The proceedings in the Council were, so far as the deputation were concerned, of a regular, almost circumspect, order, as will be seen from the report given below. The objurgations which enliven the remarks of speakers at what are called "organizing meetings" were laid aside, and moderate statements took their place. It is one thing to "organize" a working man, and another to "organize" a well-informed town councillor. This revelation shows that those who are directing this movement mean business, and that they are men of ability, or at least of discretion, who can frame a policy on prudent lines. The Town Council will therefore do well to be on their guard, and not be led away into the too common region of false security, or into the more fatal course of despising their enemy; for enemies these are, to public order, which, in the end, is the public interest or weal. The deputation were heard out of courtesy, against which nothing can be said, because they were citizens; and then, as they were not members of the Town Council, they had to retire from the precincts, and leave their cause to be dealt with and fostered by their friends in that body. The Council were unable to come to an agreement on the subject, and have adjourned it till they take up the two motions dealing with the same question, of which notice has been given. This is about the only course which could have been adopted. Let their deliberations be as calm as possible. A remit to a Committee to make inquiries is a course which should be well considered. It would be interesting to know how Conciliation Boards have worked, or maybe have been worked, in the places where, as the Town Council were informed, they are already in existence. There is nothing like ascertaining the facts, as it helps to a decision upon any subject. If time and pains be taken to inquire, much misapprehension will be removed; and although the end may be the rejection of the conciliation proposals, it will more probably be less of a convulsion.

At the Meeting of the Corporation of Glasgow on Thursday, the 21st ult.—Lord Provost Chisholm presiding—the Deputy-Clerk (Mr. Monro) read a letter from the Chairman of a meeting held in the City Hall in regard to the proposal to form a Board of Conciliation and Arbitration in connection with the Gas Workers' and General Labourers' Union. A request was made in the letter that a deputation appointed at the meeting should be received by the Council. Treasurer Murray thought that, after the decisive vote at the last meeting, they need not take up time in hearing a deputation on a subject which could not possibly be considered for six months. He moved that the deputation be not received. Mr. Graham seconded the motion. Mr. Cronin said it had always been customary to receive any number of citizens with the utmost courtesy, and to hear what they had to say; but Treasurer Murray now proposed to depart from that position, and do nothing of the kind. He was well aware that five-sixths might not agree with what the deputation might say, but it was only courteous to hear them. He begged to move, as an amendment, that the deputation be received. Bailie Ferguson seconded the amendment, which, on a division, was carried by 28 to 24—one declining to vote. The deputation, which numbered about 25, was then received. Mr. Cronin, in introducing them, said that they represented the Trades' Council, the Workmen's Municipal Election Committee, and the Independent Labour Party. Mr. J. Burgess, the Acting District Secretary of the Gas Workers' Union, said that the object of the deputation was to petition the Council to consent to the formation of a Board of Conciliation and Arbitration on the lines suggested in the recent memorial of the Union. This involved a recognition of the right of the workmen to be represented by the officials of the Union with which they were connected. This was a principle that already obtained in a large number of corporations and administrative bodies—practically in all such bodies controlling areas in which Trade Unions of corporation employees existed. If such a Board were established, the method of working would be by frequent conferences between the heads of departments and the officials of the Union, the Board only meeting when an amicable settlement between the representatives of both parties could not be made. Leaving out of consideration altogether the question of workmen's grievances, they believed it could be demonstrated that the formation of a Conciliation Board would be to the advantage of the Council, and especially would tend to promote the peace of mind of heads of departments. The Lord Provost said the statement which had been made would receive consideration. The deputation then withdrew. After discussion, in the course of which several motions were made, it was resolved that consideration of the statement should be delayed until two motions, of which notice was given at the previous meeting, should be submitted.

The latest published statement places the number of prepayment meters in use at Huddersfield at 4188, of cooking-stoves at 1059, and of heating-stoves at 90.

MANCHESTER CORPORATION GAS SUPPLY.

The Vacant Engineership—Workmen's Wages—Projected Extensions.

At a Meeting of the Gas Committee of the Manchester Corporation held just before Christmas, reference was made to the appointment of a Chief Gas Engineer, in succession to the late Mr. G. E. Stevenson, applications for which position have already been received. The matter is in the hands of a Sub-Committee. At a previous meeting of the Committee, it was decided to recommend the Council to make a grant of £5000 to Mr. Stevenson's widow; but this matter will have to come before the Council for confirmation before anything is done. Another important subject which was under discussion by the Committee at their last meeting was the remuneration of the workmen in the Gas Department; and partly as a concession to the known feeling of the men, it was unanimously decided to recommend an advance of 5 per cent. on the present rate paid to the employees of the works, in the streets, and elsewhere. This proposed advance does not affect artisans, who, as heretofore, will be paid the rate of wages ruling in the district. One or two other concessions and re-arrangements were also agreed to in the interests of the men, among which was a decision to grant time-and-a-half for one extra shift on Sundays. Hitherto this has been allowed for two shifts; but in future it will, if the recommendation is carried out, be allowed for three shifts. The estimated extra expenditure involved in the proposed wages concessions will be about £6000 a year; and this will, no doubt, allay any dissatisfaction that may have existed on the part of the men. The Committee had also under consideration the question of increasing the make of gas, with the view of being better prepared next winter to meet any extra demand; and it was decided to recommend that a certain portion of the works should be enlarged, with the object of increasing the productive capacity by 3½ million cubic feet per day. The measures recommended by the Committee will in all probability come before the City Council at their meeting to-morrow.

With regard to the appointment of a Chief Gas Engineer in succession to Mr. Stevenson, we understand that for the present this is being held in abeyance, and that practically nothing definite will be done at the meeting of the Council to be held to-morrow; the Sub-Committee, who have received a number of applications, having in the meantime the question under consideration.

BELFAST CORPORATION GAS SUPPLY.

Record Outputs—The Value of Auxiliary Carburetted Water-Gas Plant.

The introduction of electric lighting does not seem to have proved a serious obstacle to the increase of gas consumption in the progressive city of Belfast. From figures given in the local newspapers, it would appear that on no less than four days recently records were made only to be broken. Previous to last year, the largest single day's output had been 7,740,000 cubic feet—on Dec. 24, 1896. The largest single day's consumption in 1898 was on the 23rd of November; and it only reached 7,338,000 cubic feet. The following are the figures relating to the four days above referred to: Dec. 13, 8,250,000 cubic feet; Dec. 19, 8,254,000 cubic feet; Dec. 20, 8,569,000 cubic feet; Dec. 22, 8,785,000 cubic feet. It will thus be seen that on the 22nd ult. the output exceeded the largest day's delivery in 1898 by 19¾ per cent., and the previous record of 1896 by 13½ per cent. This sudden and quite unexpected demand was easily met by the use of extra carburetted water-gas plant; and though the total storage, including the contents of the relief holders, only amounts to barely 6 million cubic feet, there was no occasion to restrict the pressure at any time. On the contrary, extra daylight pressure was given to accommodate the shopkeepers during the busiest week of the year. The large additional output, and the satisfactory manner in which it was furnished, must have been highly gratifying to the Corporation Gas Committee and to Mr. Stelfox, their Engineer, who doubtless had reason to be thankful for the assistance rendered by his water-gas plant.

THE PROPOSED MUNICIPALIZATION OF THE CARDIFF GAS-WORKS.

The Gas Company Refuse to Negotiate.

Last Friday week, the Committee appointed by the Cardiff Corporation to communicate with the Directors of the Cardiff Gas Company with a view to opening negotiations for the purchase of the undertaking held a meeting—Sir THOMAS MOREL presiding.

The TOWN CLERK reported that he had communicated with the Secretary of the Company, and had forwarded to him the resolution of the Council, which embodied an inquiry whether the Company were prepared to open negotiations for the sale of their undertaking, and upon what terms. The letter was acknowledged on Nov. 8, stating that the Directors would give the communication their consideration. A further reply had been received from the Secretary, dated Nov. 20, in the following terms: "Your letter of the 7th inst. has been submitted to, and considered by, the Directors of the Company; and, in reply, I am directed to state that the Directors have no desire whatever to part with the undertaking, and are not prepared to open negotiations for the sale of the Company's property."

The CHAIRMAN (in response to a remark by a member of the Committee, that this letter settled the matter) said the communication read by the Town Clerk was quite contrary to what the Directors had told him verbally. He had been to see them on other matters; and they said that the reasons they had sent the letter in were that the discussion at the Council had been of such a nature, and such pronounced opposition had been shown by some members, and statements made rather depreciatory of their property, that they had thought it would be the best thing to write as they had. They, however, still gave him to understand that if the Corporation were really serious in the matter, and would look at the value of the property in the right way, they would be prepared to still consider the proposal in the manner they told him in the first instance.

Alderman JONES pointed out that the Directors had sent him an answer in black and white, stating that they would have nothing to do with the negotiations at all; and so far as he could see they were not likely to carry out the transaction with them.

The CHAIRMAN said there was a mode of finding out the value of the undertaking; and on these terms he believed the Directors were prepared to consider the matter. Ten years ago the Directors had made up their minds not to enter into any negotiations with the Corporation; but they were open still, as business men, to consider the matter in a business way. When questions of this kind were discussed in public, there was bound to be a certain amount of friction. The Corporation had the water-works in their own hands; and this question of public lighting was of equal importance. He really thought, therefore, they should pursue the matter further. He suggested that a Sub-Committee should be formed to report to the Committee. He could easily obtain an interview with the Chairman and some of the Directors of the Gas Company, and arrange for them to meet the Sub-Committee and talk the matter over.

Mr. JENKINS said that the duty for which the Committee had been appointed had now been discharged. They had been appointed to negotiate with the Company; and the Directors had now absolutely refused to have anything to do with the Corporation so far as the sale of the undertaking was concerned. The Committee could not go any further now without fresh instructions from the Council. If the Council thought it would be wise to negotiate further, well and good.

The CHAIRMAN said he should be sorry if the negotiations came to an abrupt end. The matter was of such importance that he would treat it as a business transaction; and as a business transaction he would carry it through.

Mr. JENKINS pointed out that the letter from the Directors was an absolute refusal.

The CHAIRMAN said they must take the letter with the statement he had made; and his advice was that they should probe the matter further, and see to what extent it was meant.

Alderman JONES said that, under ordinary circumstances, business men met one another to discuss a business matter after absolute refusal to negotiate; but when a public body received an answer of this kind from another public body, it seemed to shut out any hope for negotiation. In the absence of the withdrawal of the letter, the Corporation would have to go cap in hand and ask the Directors to negotiate; he did not see what they could do in the face of the letter. If the Chairman could get the matter re-opened, they could attend to it; but the Directors absolutely shut it now. To assist in keeping the question alive, he moved a resolution to the effect that the matter be left in the hands of the Chairman to ascertain whether the answer of the Directors of the Company was really a final one.

Alderman BEAVAN seconded.

On the suggestion of the Town Clerk, the resolution was amended to read, "That the question be adjourned; and that in the meantime Sir Thomas Morel be asked to continue his inquiries."

The resolution was put and carried unanimously.

ELECTRIC LIGHTING NOTES.

The Whitechapel District Board of Works have just completed an installation of electric lighting plant at a cost of £70,000; and the current was switched on for the first time on the 21st ult.

The Oswestry Town Council concluded not to proceed with their application for an Electric Lighting Provisional Order until the result of the recent Local Government Board inquiry is known. This inquiry was relative to a loan of £18,000 for the purchase of the Electric Light Company's undertaking and making certain extensions. There was a very strong opposition to the application; and, in view of this, the action of the Council is rather significant.

Some months ago, the Wigan Corporation decided to erect works for the supply of electric light in the borough, and they are in course of construction. It was desired, however, that the past year should not close without a temporary supply being afforded; and accordingly the necessary arrangements were made by the Electrical Engineer (Mr. H. Collings Bishop). The plant has been erected at the gas-works; and on the 20th ult. the current was switched on by the Mayor (Mr. J. T. Gee), in the presence of a numerous company.

Small towns searching for truth as to the expense of lighting streets by electricity have here the actual experience of Whitehaven. When the town adopted electricity, some £800 or £900 was the sum set down as the price of street lighting, to put against the cost of gas. In the last financial year, the cost of public lighting is set down at £1441—that is, the amount of credit taken for current supplied for public lighting. In addition to this, there was paid for public lamps £452 16s. 9d. Altogether the cost of public lighting for the year approached £1900.

In consequence of the repeated failure of the electric light in the Marylebone district, a meeting of residents and tradesmen interested was held a few days ago, at the Portland Hotel, at which it was decided to take common action with a view to obtaining a better supply in future, and compensation for the loss now being sustained. Dr. Fletcher Little, in urging the adoption of this course, pointed out that in St. Pancras and Hampstead the electric lighting arrangements were in the hands of the Vestry; whereas in Marylebone the right had been given to a private Company who had to be legally compelled to fulfil their obligations.

A sad fatality occurred at Bolton on the 22nd ult. in connection with the Corporation electric light undertaking. Three workmen were engaged in removing the transformer at the underground sub-station, when one of them, named William Hazelton, a Londoner, made a mistake by switching the wires wrongly; thereby charging the transformer with 2000 volts of electricity from the principal generating station. The result was that all three men were rendered insensible; and flames and smoke shot into the air, creating great consternation among the townspeople. A Corporation Inspector, named Albert Sides, gallantly descended and rescued the men; but Hazelton died later from asphyxia, while a second workman, named Walker, died on Saturday morning, never having

recovered consciousness. The circumstances attending the fatality were the subject of a Coroner's investigation last Tuesday, when a verdict of "Accidental death" was returned. The Electrical Engineer to the Corporation (Mr. A. Ellis) remarked that, notwithstanding all the precautions that were taken, transformers were a source of danger; and he stated that the Corporation were spending £30,000 in introducing an improved system.

A special meeting of the Dublin Municipal Council was held last Thursday to receive a report from the Electric Lighting Committee, submitting for approval a scheme prepared by Mr. Robert Hammond, the Consulting Electrical Engineer to the Corporation, for the extension of the present electric lighting system, at an estimated capital expenditure of £254,500, made up as follows: Mains, &c., for private supply, £103,000; public arc lighting, £40,500; Pigeon House works, £96,000; meters and house connections, £15,000. It was explained that the proposed plant would have a capacity of 3000 kilowatts, but that it would be prudent to treat one set as "reserve." This would leave 2000 kilowatts available, or (say) with 10 per cent. extra at top load 2200 kilowatts. Of this, 300 kilowatts would be used for the arc lamps; leaving for the private lighting 1900 kilowatts, capable of dealing with 63,300 lamps of 8-candle power, all alight at one time, or (say) 95,000 lamps fixed on consumers' premises. The following estimates were given by Mr. Hammond: Revenue—95,000 lamps, using 16 units each per annum, or 1,520,000 units, at an average price of 4½d., £28,500; meter-rents, £1000; 500 arc lamps, at £18, £9000; total, £38,500 (carbon and trimming being paid by the Lighting Authority). Expenditure—Private lighting 1,520,000 units, public arc lighting 1,125,000 units, together 2,645,000 units, at 1·5d., £16,531; gross profit, £21,696, to provide for interest and sinking fund. In conclusion, Mr. Hammond said that, when the demand justified the laying down of an additional 1000 kilowatts set, the output for private lighting could be increased by 760,000 units. The gross profit arising therefrom would increase to £31,469. Alderman Meade moved the adoption of the report, and stated generally what the Corporation proposed to accomplish. He said that, taking the amount to be received at £38,500, and the cost of production and delivery at £16,531, they had £21,969 to deal with. The proposed cost being £254,500, as they could get their money at £4 12s. 6d. per cent., paying off the loan in 40 years, this came to £11,748. They had also to provide for the expenditure on their present works, which he had put down at £80,000. This at £4 12s. 6d. per cent. came to £3700, which left a surplus of £6521 per annum for the Council to deal with as they wished. As, by putting down an additional set of 1000 kilowatts, at an extra cost of £40,000, the gross profit could be increased by, as Mr. Hammond calculated, £7500, the surplus would then amount to £14,000 a year; and the result would be that in forty years' time all the works, mains, engines, and plant, would be the absolute property of the Corporation of the day, without having to pay anything towards it. He submitted that, in the interests of the city, the work was one which should be undertaken without further delay. He begged to move—"That Mr. Hammond's scheme be adopted; that your Committee be empowered to apply to the Local Government Board for their sanction to a loan of £254,500 (the Law Agent and the Town Clerk to take any legal steps that may be essential to this end); and that your Committee be further empowered to alter the schedule of streets attached to the report if they consider it advisable." Mr. Pile seconded the motion, and it was unanimously adopted, with an alteration of the third recommendation so as to read "if it is considered advisable."

Professor Silvanus P. Thompson has replied in "The Times" to the letter of Mr. Montague Crackanthorpe, given in last week's "Notes," on the subject of the fire caused in his house through damage to the insulating material of the electric light wires. It may be remembered that Mr. Crackanthorpe advised the use of some incombustible mineral material as an insulator for the wires. Professor Thompson says he would advocate the total abolition everywhere, except in laboratories and factories, of the use of wood casing for covering the wires. In this view he knows he is at variance with many of the authorities and with half the electric lighting contractors. He would not allow a single inch of wood casing in his own house. When he wired it about six years ago, he decided, in the teeth of all the existing fire insurance rules, to exclude wood casing, and to employ instead either wires drawn into incombustible pipes or wires the insulation of which was protected by an armouring of lead. Lead-armoured twin conductors, braided together externally with an outer braiding, tarred or painted, constitute the main part of the wiring of his house. Such protected conductors are, he says, air-tight, water-tight, electric-tight, gas-tight, and rat-tight. They can be either embedded in the plaster of the walls, secured against its surface, or run under the floors, with the utmost security. In cases where internal conduits are employed, these likewise may be embedded in plaster or run under the floors with safety. He goes on to say: "Another point of divergence from the fire rules that were in favour six years ago is the absolute avoidance of fuses in ceiling roses and other inaccessible places. On the other hand, I rigidly exclude from permissible things, though permitted by the insurance inspectors, the existence of any joint, soldered or otherwise, however well made, in an inaccessible place under a floor. All branch wires must be continued back to some accessible place, where they can be brought to a joint-box or fuse-box. Much too great reliance has been placed by insurance officers upon the use of fuses, with the result that there are far too many of them, and they are put in all sorts of bad places; for example, in ceiling roses, and at every place where flexibles are joined to the leads. Far too little stress has been placed on the necessity of not allowing any joint where it cannot be inspected. But the greatest defect of all is this foolish allowance of the use of wood casing. Behind it bad workmanship and bad jointing lie hid. As wood casing is difficult to carry between floors, it is often omitted in such parts, and the wiring goes unprotected in these uninspected regions. Also, when wood casing passes along a damp wall, it may, except in those cases where alternating currents are supplied, set up new troubles arising from electrolytic conduction." He concludes by saying that the main endeavours should be to get rid of wood casing at all costs. If its use is prohibited, every wiring contractor will be compelled to adopt methods which allow less scope for bad workmanship, and the chance of fire will assuredly diminish. Mr. A. Lester Taylor, of Liverpool, however, characterizes Professor Thompson's letter as "needlessly alarming." He states that, on looking over carefully compiled statistics of fires of electrical origin in this country during the past twenty years of his own experience as an engineer in connection with electrical installations of all kinds, aided by the specially detailed information available in his position as a fire office adviser, he cannot find a single instance of any serious fire loss having originated through the use of wood casing, or one which would probably not have occurred had some other method of enclosing the wires been adopted. He points out that there are other excellent methods of enclosing or supporting conductors, as detailed in fire office rules—some being decidedly preferable to wood casings in a few situations; but the wholesale condemnation of these casings in a manner so disturbing to the great majority of users of current in this country is, he says, certainly "not justified by actual experience." Another correspondent, writing from his own personal experience, suggests, in place of the abolition of wood casing, the use of non-flammable wood, which, while being a non-conductor, is an inexpensive method of rendering electric wires innocuous.

Mr. Crackanthorpe replied in "The Times" of Monday last week to Professor Thompson's letter. He commenced by expressing regret that he had not had the advantage of the Professor's opinion before he used wood casing in his two residences—one in London and the other in the North of England. In his London house, he is forced by the Electric Lighting Company to receive a current of 200 volts, which, being double the voltage he requires to overcome the resistance of his lamps, subjects his insulation to a penetrating force twice as powerful as need be brought to bear upon it. In his country house, he never has more than 100 volts delivered from the accumulators, and when the lights are on he finds that a current of 96 or 97 volts is the most beneficial for the eyes. But there he regulates his voltage at will, since he generates his own electricity by water power. His recent unpleasant experience was not unique, for he subsequently received a communication from a distinguished artist stating that a similar accident had occurred to him. In Mr. Crackanthorpe's previous letter, he mentioned three precautions against insidious electric fires: (1) Outside wiring; (2) abolition of wood casing; (3) testing periodically for leakage, both by the pole-to-pole and the earth test. In his second letter, he enlarged a little on No. 2, since the proposal would, he said, be regarded as revolutionary by the trade. His remarks on this point were as follows: "Professor Thompson's words are, 'the main endeavour should be to get rid of wood casing at all costs;' and he suggests that we should employ instead 'either wires drawn into incombustible pipes or wires the insulation of which is protected by an armouring of lead.' The latter, he tells us, is the way in which his own house was wired about six years ago, and he holds his apparatus to be 'air-tight, water-tight, electric-tight, gas-tight, and rat-tight.' I should be sorry to ruffle a feather of my friend the Professor, for whose scientific attainments I have the most sincere admiration; but I confess that I am not entirely satisfied with his lead armouring for general use. As was pointed out in a paper read last year by Mr. Frederick Bathurst before the Incorporated Association of Municipal and County Engineers, 'lead coverings are liable to rapid deterioration when in contact with the strong chemical cements and plaster now commonly used in building construction;' and just as rats and mice occasionally attack lead-covered gas and water pipes, so also will they attack lead-covered wires, regardless of the consequences to themselves that may ensue. The Conduit and Insulating Company, Limited, claim to have solved the insulation-protecting problem by running the wires through an iron tube carrying on its inner surface an insulating lining so expanded by pneumatic pressure as closely to fit the tube. I pass no opinion on this contrivance, except to say that it seems to be both fireproof and waterproof, also (so far as the lining goes) non-conducting. The material is, however, heavy and, I should imagine, expensive. Another much cheaper method is to employ wood casing, but not until it has been treated by a special process, so as to be incapable of transmitting fire to other wood. . . . In my previous letter I also referred to asbestos; and there is no doubt that asbestos, such as that obtained from the neighbourhood of Montreal, will, when mixed with good cementing materials, bear an enormous amount of heat without its durability being impaired. . . . There is yet another method to which I also referred—viz., the use of Uralite. The Manager of the British Uralite Company, Limited, wrote to say that this material was about to be further tested, and that he believed it would prove a success. I do not know how this may be, and shall await the result of the further testing with considerable interest." Having enumerated the substitutes for wood casing which had come to his knowledge, Mr. Crackanthorpe concluded his letter as follows: "The question is, Who is to decide between them? In the United States, the fire insurance authorities have established an electrical bureau, whose business it is to examine and test electrical apparatus, to record particulars of electric fires, and to discover their probable origin. Can such a bureau be established here? I suggest that it can, and that the nucleus of it already exists in the Electrical Department of the London County Council. That body sends us its admirable Fire Brigade, and, after the fire is well over, if it is reported to have occurred through electricity, it sends us a highly-trained official to endeavour to ascertain the specific cause. These causes are, I presume, duly tabulated and classified. Prevention is, however, better than cure; and there are many of us who would be glad to have had the benefit of this departmental experience before we wired our houses. It is perhaps too much to expect that the Insurance Companies will unite and revise their rules made some eighteen years ago; and, failing such revision, we must look elsewhere. The London County Council might, as it seems to me, take the matter in hand, might examine the competing substitutes for wood casing with the aid of impartial experts, and might recommend to the ratepayers of the Metropolis such methods of electric lighting as can be adopted at the least cost compatible with perfect safety."

The Supply of Coke-Oven Gas in Boston (U.S.A.).—We learn from the "Boston Advertiser" of the 5th ult. that the Massachusetts Pipe-Line Gas Company made their first delivery of gas from the works of the New England Gas and Coke Company the previous night; the gas being sent through their mains to the Jamaica Plain Gaslight Company. It was expected that in the course of the next few days gas would be delivered to the Brookline Company at the rate of a million cubic feet per day, which would be gradually increased within two weeks to 2½ millions, the present output of the Company. The plant, it may be remembered, was described in the last volume of the "Journal" (pp. 1114, 1176).

THE WELSH WATER SCHEME OF THE BIRMINGHAM CORPORATION.

"The Times" of Monday last week contained the following article, from a correspondent, on the Welsh water reservoirs of the Birmingham Corporation. It is interesting in connection with the particulars as to the progress of the works furnished in the last report of the Water Committee of the Corporation, noticed in the "JOURNAL" for the 5th ult.

The four great dams on the River Elan which will form the reservoirs for the future water supply of Birmingham have reached a point of progress when some idea may be conveyed of their dimensions, strength, and storage capacity. . . . An obscure and thinly-populated valley in Radnorshire, on the higher reaches of the Wye and its minor tributaries, has been transformed into a populous though shifting community, and into a scene of big engineering undertakings. The future water supply of Birmingham will, of course, be a vastly improved one; and as the period of ten years allotted from the date of the Royal Assent to the Bill for the completion of the works expires on June 27, 1902, the city may be said to be getting within measurable distance of the realization of that benefit. But even with this improved supply, Birmingham will fall very far short of the magnificent provision of water with which the ancient city of Rome was blessed. Indeed, even London itself falls considerably behind the old Roman capital. In A.D. 100, no less a quantity than 300 million gallons of water, conveyed in aqueducts ranging from 30 to 60 miles in length, flowed daily into Rome; while London to-day, with its five millions of population, has but 200 million gallons. The daily supp'y to Birmingham from the present sources, including draught on storage, is about 20 million gallons. The daily supply from the new works, when completed, is estimated at 99 million gallons, of which 27 millions go for compensation; leaving 72 millions for actual supply. The cost of the construction of the various reservoirs and the aqueduct complete, as regards tunnel and cut-and-cover work, and two lines of pipes in syphon to Birmingham, will probably be about £4,500,000.

The Birmingham Corporation railway to the uppermost dam starts from the Elan Valley Junction at a point near Rhayader, on the Mid-Wales Railway; and the first dam reached is that of Caban Coch. The foundations of this dam on the Breconshire side had at the time of a recent semi-official inspection been carried to a depth of 30 feet below the bed of the river, in order to get beneath natural fissures through which a leakage might occur. The masonry superstructure on each side of the river has been carried up to a height of over 40 feet; and while the excavation of the middle portion is proceeding, the water of the river passes through a 16 feet culvert on each side. When completed, this dam will be 600 feet in length across the valley, and from 120 to 122 feet in height. The river bed is 700 feet above Ordnance datum; therefore the top level of the reservoir will be 820 feet above Ordnance datum. The foundation stone of this dam was laid on Oct. 8, 1896, by Mr. Lawley Parker, Chairman of the Elan Valley Water Supply Committee, and on May 28, 1897, Mr. James Smith, Lord Mayor of Birmingham, laid a commemoration stone 25 feet above the foundation stone. This reservoir will extend about four miles up the valley, including a reach along the River Claerwen; and its capacity will be about 8000 million gallons. The area drained is 45,562 acres; but portions of this drainage will be impounded by two of the higher reservoirs—namely, Pen-y-Gareg and Craig Goch. The flood discharge is reckoned at 15 cubic feet per acre per minute, or a total of 683,430 cubic feet per minute, or 300 million gallons in 24 hours. The top-water level of the Caban Coch reservoir will extend very nearly to the base of Pen-y-Gareg dam. The geological formation in this locality is silurian grit and conglomerate—an exceedingly hard stone; and an enormous amount of masonry has been excavated from an adjacent quarry on the Radnorshire side of the river. The Elan has usually flowed with a volume of 4 million gallons daily; but long-continued drought has reduced this discharge to 3 million gallons, as determined by gauge. The compensation water has been fixed at 27 million gallons, or nine times the present natural discharge of the river; and this compensation water will be delivered from the Caban Coch dam to the Wye. An important provision for the benefit of the salmon fisheries and for cleansing the river by artificial "spates" is guaranteed by the Act. One-fifth of the 27 million gallons daily compensation must occasionally be reserved each day for a fortnight, and discharged during 48 hours together with the daily allowance.

We come next to the submerged dam at Careg Ddu, a few yards below the tunnel which marks the commencement of the intake of the 72 million gallons daily supply of water to Birmingham. It is situated near the middle of the four miles of reservoir between the Caban Coch dam and the Pen-y-Gareg dam. Its crest, 780 feet above Ordnance datum, is 46 feet below the top-water line (820 feet) of the Caban Coch reservoir in which it is submerged. Should the reservoir fall, in any long-continued drought, to the extent of 40 feet, the crest of the submerged dam would become visible, and the water above the submerged dam would be there impounded, and retained solely for the supply of Birmingham; while the daily compensation to the Wye would be drawn solely from the portion of the reservoir below the submerged dam. So far as the dam is concerned, it is practically finished; but a great deal of work remains to be done to carry a roadway over the reservoir upon seven segmental arches, each of 48 feet span, resting upon piers built upon the dam. Visitors to the works show much interest in this submerged dam and in the mouth of the tunnel, the arched floor of which is 770 feet above Ordnance datum, or 170 feet higher than the storage reservoirs at Birmingham. The total length of the tunnels, conduits, syphons, and pipes is 73½ miles; and the water will flow through them at rather less than two miles an hour—in other words, the passage of any given portion of water from the intake to Birmingham will occupy about 40 hours. As a general rule, the fall in the tunnels and in the cut-and-cover conduits will be about 1 in 4000, or about 16 inches per mile; whereas the fall in the syphons and iron pipes will be about 1 in 1760, or 36 inches per mile. The length of the Foel tunnel is 7160 feet, or nearly 1⅓ miles.

The Pen-y-Gareg dam is built across the valley of the Wye to a height apparently of 60 or 70 feet. When completed, it will have an extent of 525 feet, and a height of 128 feet. The base of this dam is practically on a level with the top water of the Caban Coch reservoir below it. The extent of this reservoir, to the next dam at Craig Goch, will be two miles, and the top-water level of the reservoir will be 945 feet above Ordnance datum. When full, it will have an area of 124 acres and a capacity of 1320 million gallons of water.

The Craig Goch dam is the last and uppermost of the four. It is eight miles from the Elan village. In this case, a culvert has not been made in the base of the dam for the passage of the river during the execution of the dam, but a tunnel has been bored through the solid rock at its eastern extremity. When completed, the extent of this dam across the valley will be 625 feet, and its height 120 feet. The top-water level of the reservoir will be 1040 feet above Ordnance datum, and its length will be two miles. When full, it will have an area of 217 acres and a capacity of 2000 million gallons.

The excellent character of the entire work is everywhere conspicuous along the ten miles of specially constructed railway from the Elan Valley Junction to the head works up the valley. The organization of each dam strikes the observant spectator as perfect. The huge masses of stone which are transported in the trucks and deposited in the beds of concrete prepared for them are matters for astonishment. Each load of stone moved by the travelling crane is weighed; one object of this process being to assist in the calculation of the entire mass of the superstructure opposing the weight of the water pressure. Masonry revetments are formed in the sloping banks of the reservoir. These are very necessary under newly-made roads, and especially on the exposed banks of the Caban Coch reservoir, where the wind is at times strong enough to create along the sides of the funnel-mouthed gorge waves that will exceed in height the roll of the Severn "bore."

The following statistics of the rainfall in the locality of the reservoirs are interesting: The mean annual rainfall at Nantgwillt, recorded by the late proprietor (Mr. R. Lewis Lloyd), for a period of 20 years, commencing in 1871, was 63·78 inches. The gauge was 768 feet above sea level. The mean altitude of the watershed is 600 feet higher. Mr. Mansergh, the Engineer of the works, calculates the rainfall on the gathering ground at 66 inches; and he thinks it possible, with sufficient storage reservoirs, to collect 40 inches of it.

PROPOSED AUXILIARY WATER SUPPLY FOR NEW YORK.

Proffered Help by a Water Company.

American engineering papers have lately contained particulars respecting a proposed scheme of auxiliary water supply for New York which has been made the subject of inquiry by a Commission of the Legislature. It appears that water is very short in some districts, and that the authorities have to put forth great efforts to prevent a famine. The supply is barely equal to the demand, the population is increasing, 130 gallons of water per head are required, and there is great waste. In these circumstances, an offer was made by the Ramapo Water Company to supply the city with 200 million gallons daily from the Esopus watershed. The offer, far from being cordially received, as one might have expected, has given rise to considerable feeling on the part of the citizens, who characterize the offer as a "job." A recent number of the "Engineer" contained an article on the subject, from which we make the following extracts.

The Ramapo Water Company—which was incorporated as long ago as 1887 for the purpose of furnishing a supply of water to New York—offer to deliver 200 million gallons daily, at a head of 300 feet, at the northern boundary of the city, at the point of intersection with the New Croton aqueduct. The contract price for this water is to be $70 per million gallons. This price would not include anything for distribution or storage; and it is not at all out of the way to place the price of supply to consumers at $100 per million gallons. Let us see what this figure works out to be. The daily amount is, as already stated, 200 million gallons. The daily charge would, therefore, amount to no less than $20,000; and, supposing New York agrees to take an equal amount every day throughout the year, the huge total of $7,300,000, or (say) £1,460,000, is obtained. It is this expenditure that the citizens of New York complain of. There would seem to be ample grounds for grumbling. It would appear that only four years ago an authoritative estimate was got out for supplying only 100 million gallons a day to the Ridgewood reservoir in Brooklyn from the same source—the Ramapo. This estimate showed that the cost would be only $16 per million gallons; and the water would have had to be conveyed across Long Island Sound. The supply to New York would, it is said, be obtained some time in 1902. This, again, is a point of dispute; for it is contended that it would be impossible for the necessary works to be completed in the time. Then, again, the contract is only for forty years, after which time, if the Company choose to withdraw, New York might have to look out for another source of supply, building works of its own, or the Company, if they went on working, might get their own terms.

The engineering Press is most emphatic in its opposition to the scheme, and it seems to think that the measure will not obtain the sanction of the authorities. It is pointed out that the proposed contract does not provide for a proper approval of the plans and construction by the city. Then, again, it is stated that the Company promise impossibilities; that the Engineer is a young man without experience in designing or building such enormous works, "and people who know how difficult it is to properly plan and build great dams will require more than his word, or that of the Engineer of the Commissioner of Water Supply, to convince them that reservoirs can be built in three years in the Esopus Valley which will ensure a supply of 200 million gallons a day by 1903." It is urged that no proper surveys have been taken; while no less than $100,000 were expended in borings alone in order to find the best place for the great Croton dam now in course of construction. A work, we are told, of the magnitude of that at present proposed, "entered upon so blindly, absolutely without competition, is simply unprecedented in the history of engineering and municipal public works; and it is made all the more notorious because it is proposed at a time when the most marked feature of municipal administration is the insistence on getting and keeping public water supplies under municipal control." Only nine out of the fifty largest cities of the United States are dependent upon private companies for their water supply. Four of these nine have recently taken steps to change to public ownership. Of the forty-one whose supplies are actually under municipal control, about half were originally started under private ownership.

Besides the fifty largest cities, there had been among other towns no less than 200 changes from private to public ownership up till the end of 1897. In fact, the general idea expressed at the present moment is that, whatever may be thought of the claims for municipal ownership of lighting, street railway, and telephone systems, it is now almost universally admitted in the United States that water-works should be under public ownership. The matter is summed up by a leading journal under three heads. When a city like New York finds itself in need of an additional water supply, it should engage competent and honest expert advice to determine—first, what its needs really are; secondly, what, if anything, can be done to increase or improve the present supply; and, thirdly, the best of the additional sources available.

The other side of the question—viz., the position taken up by the city authorities—is as follows: Mr. William Dalton, the Commissioner of Water Supply, in a report to the President of the Board of Public Improvements, begins by saying that the present and future condition of the water supply of Greater New York imposes upon the authorities the imperative duty of taking prompt and decisive action to remedy existing deficiencies and to secure to the people an adequate supply of pure water. The full normal supply of the borough of Brooklyn is 93 million gallons for an estimated population of 1,200,000 persons. About three-fifths of this supply is obtained from flowing streams and ponds, and about 40 million gallons has to be pumped out of the soil from driven wells. The entire supply has to be pumped to a height of 170 feet. Some of this has again to be pumped another 50 feet, and some again 80 feet more. The available supply has not increased for five years, while the population has done so materially. Were Brooklyn to be supplied at the same rate per head as other portions of Greater New York, there would now be needed a daily supply of 150 million gallons. In the borough of Queens, the conditions are even worse. The entire supply is obtained from wells, and some of these are so near the shore of East River or Long Island Sound, that the pumping of water from them has to be carefully limited, so as to prevent the drawing of an admixture of salt water. Some of the wells, too, have surroundings where there is a constant increase in population, which will in a short time compel an abandonment of wells in consequence of pollution from house drainage. The wells are worked to their maximum capacity, producing a supply of 3,350,000 gallons of water per day. This is quite inadequate for present needs, much less for an increased population.

The Commissioner estimates that the present needs of this portion of the city are some 6 million gallons. New York proper, consisting of the boroughs of Manhattan and the Bronx, has had an average consumption during the last six months of 265 million gallons a day. During June and July, the maximum rose to 286 million gallons daily, which is a 12 per cent. increase over last year's amount. The combined capacity of the old and new Croton aqueducts and the Bronx River conduit, which are now the only means of conveying water to these boroughs, is 400 million gallons a day. At the present rate of consumption, the limit of capacity will be reached in four years or less; and on the basis of a 10 per cent. increase it will be reached in less than five years. The entire supply from the Croton, Bronx, and Byram watersheds comes into the city by gravitation. The maximum elevation to which the water can be delivered is 119 feet; in many places it is considerably less than this. The demand for high-pressure supply continues to grow at a constantly increasing rate. In the borough of the Bronx there is as yet no high-pressure service, and many portions of it lying on higher ground are not supplied. The amounts which will be required at the end of four years are estimated by the Commissioner to be as follows: Brooklyn, 136,161,000 gallons; Manhattan and the Bronx, 387,986,000 gallons; Queens, 11,450,000 gallons—total, 535,597,000 gallons. And in ten years he estimates that this figure will have reached 640½ million gallons.

Foreseeing that some additional supply must be obtained, the Commissioner made a tour of inspection, accompanied by four engineers "of high standing." Two of these were the Chief Engineer of the Department of Water Supply and the Chief Engineer of the Board of Public Improvement. The names of the other two are not given. These gentlemen visited the highlands of the Hudson, and part of that district which is generally described as the Catskill Mountains. The particular section of the Catskills visited embraced the valley of the Esopus Creek, the upper water of the Schoharie Creek, and the head waters of the east branch of the Delaware River. Here there are a large number of natural sites for storage reservoirs which can be made available with comparatively small cost for the construction of dams, sluices, &c. Seven proposed sites for reservoirs were examined. These were the Fort Montgomery site, which is 40 miles from the city, has a watershed of 45 square miles, has an elevation of 400 feet, and will flood about 150 acres; the Popolo site, which has an elevation of 500 feet, and an area of about 250 acres; the Mine Pond, which is 600 feet high, and has a natural area of 10 acres; Lake Popolopen, which is over two miles long and 1000 feet wide, and 650 feet above sea-level; Lake Hill site, which can be flooded to 300 acres at an elevation of 1050 feet; the Coal Brook reservoir, in the Esopus Valley, which can be made to contain 15,000 million gallons at an elevation of 675 feet; and the Olive reservoir site, which can be made to impound 7000 million gallons. The area of all the watersheds of the above is in excess of 1400 square miles. The rainfall is said to be 15 per cent. in excess of that of the Croton watershed. The population averages not more than ten to the square mile. The geological and topographical features point to a large percentage yield of potable water; and it is estimated that ultimately a daily amount of 900 million gallons will be obtained from this district.

Then as regards cost, if the city itself undertakes the supply of water from this district, the Commissioner remarks that it must build so that the addition to the water supply shall be assured for a series of years after the completion of the works. This means that it must build reservoirs and conduits of sufficient capacity to guarantee an additional supply of not less than 600 million gallons per day, and must be ready to issue bonds to the amount of not less than $70,000,000, and possibly of as much as $100,000,000, instead of paying, in accordance with the proposal, $70 per million gallons without any further risk or expense.

Several points in Mr. Dalton's report are taken up and adversely criticized. The Brooklyn and Queens supply is acknowledged to be inadequate, even disregarding the phenomenal growth which the Commissioner ascribes to the latter borough. There have been, says one New York paper, many reports on the subject of the water supply of these two boroughs made to the Commissioner of City Works. In some of these, water from sources west of the Hudson—from the Catskill Mountains, in fact—has been considered, and in every case found more costly than a supply from other gathering grounds. "Hence," it says, "so much of the Ramapo job as depends on the needs of the Long Island portion of New York may be dismissed as beside the point." With regard to the Manhattan and the Bronx districts, while the Commissioner's figures are accepted, the waste in the former is stated to reflect little credit on the officials in charge of the distribution. In 1870, 80 gallons per head sufficed for the needs of the inhabitants. The amount has been gradually growing, particularly since the opening of the new aqueduct in 1890. In 1895 it was 100 gallons per head; now it is about 130 gallons, of which 30 gallons at least are put down as waste. It is even alleged that builders on Manhattan Island are familiar with tales of unexpected springs which retard excavation. These often occur in places where water can only come from the city mains. But even supposing that all waste was stopped, it is recognized that the time has arrived when something should be done; and it is suggested that recourse should be had to the Ten Mile River catchment area lying just north of the Croton basin. From this something over 100 million gallons of water per day can be obtained, and with comparative ease. This, it is urged, will give the authorities time to look round them. The amount of water which will be required depends upon the growth of the population. If it continues at the present rapid rate, it may be necessary to go to the Great Lakes or the Adirondack Mountains. If the population bids fair to remain nearly stationary, then the Catskill Mountains may be able to deliver all that is necessary. These are subjects, however, which it is considered are for the future. The present course is "to throw over the Ramapo job, remedy the leaking pipes, stop the waste in houses, and develop the Ten Mile River basin."

In reply to all this the Water Commissioner says that from Ten Mile River, in the Housatonic watershed, a daily supply of 110 million gallons might be obtained, but it would fail to give the much-needed increase of pressure. To obtain higher pressure, a new aqueduct would have to be built, at a cost of $40,000,000 or more. Moreover, pollution of the water would nearly certainly ensue, owing to the large population near the source. Then, too, as regards Lake George, Lake Ontario, and Lake Champlain. The water from the first would only reach New York at sea-level, and would require a tunnel 10 miles long. The cost of carrying out the work would be not less than $200,000,000. A supply from Lake Champlain would flow by gravity to Troy, where it would have to be pumped 250 feet high, so as to reach sea-level at New York, and then again be pumped to be of any use. Further, a tunnel of 56 miles would be required. From Lake Ontario water would flow by gravity to Albany, where it would have to be pumped 230 feet high in order to flow by gravity to sea-level at New York. A tunnel 50 miles long would be required *en route*. Then, lastly, a gravity supply equal to that which the Catskills would furnish could be obtained from the Adirondacks; but the works would cost not less than $500,000,000, and could not be completed in less than twelve years.

New York is truly in the thick of deep troubles. On the one hand, there are the officials, who, while grasping the gravity of the situation, yet shrink from doing the necessary work themselves, and catch at a straw held out by a private Company. On the other hand, the citizens are up in arms at what they think to be needless expense and dangerous obligations about to be undertaken. From an outside point of view there, of course, comes the question: "Why cannot the city do the work itself?" The Commissioner gives seven reasons, which, at first sight, are plausible enough, against it; but they will scarcely bear close examination. The "Engineer" thinks New York's most advantageous course is clear—viz., to provide her own water supply.

Fatal Explosion at the Lillie Bridge Oil-Gas Works.—Last Wednesday, Mr. C. Luxmore Drew opened an inquiry at Fulham into the circumstances attending the death of John Joseph Clements, aged 49, a gas maker in the employ of the District Railway Company, who was killed by an explosion at the Lillie Bridge works of the Company on the previous Saturday. William Clark, a gas maker's assistant, said that on the day in question Clements was engaged in making gas with petroleum oil, which was pumped into tanks, and then into the retorts. He was supplied with a Davy lamp to use where a naked light was not allowed; and the lamp was found hanging in a cupboard after the accident. Mr. George Estall, the Resident Engineer, explained that at the side of the oil-tank was another pit containing tar refuse, which was covered with boards, through the cracks in which the gas could escape. This refuse always threw off gas, and the prevailing thick fog would prevent it rising. As soon as it was in contact with the atmosphere, it became explosive. The oil used was crude oil supplied by the American Oil Company. He had formed the opinion that Clements, in order to see the gauge in the tank below, struck a match, and the explosion followed. Commander Wells, Chief Officer of the Metropolitan Fire Brigade, said he had visited the premises, but could not form any opinion as to the cause of the explosion. The vapour might have arisen from the petroleum or from the tar waste. The crucial point was that the man neglected to use his Davy lamp. The inquiry was adjourned. When it was resumed on Friday, Thomas Williams, the foreman at the works, stated that there had been two previous explosions, in one of which a man named Webber was fatally injured. The gauge-glass was below the level of the ground. George Simpson, stores porter, said that when Clements left him to examine the gauge he was not carrying the Davy lamp. The explosion occurred half a minute after. Edward Creedy said he had examined the gauge on several occasions, and had carried a naked light into the pit. An explosion occurred, and he was injured. Inspector Wade, of the London County Council, said he had tested the oil, and it had a flash-point of 150°. The Jury returned a verdict of "Accidental death through an explosion caused by a naked light;" but they said there was not sufficient evidence to show how the light was introduced. They added a rider that the gauge should be placed in such a position as to be read from the ground level; that ventilating shafts should be fixed to the bottoms of the pits; that the disused pit should be filled in; and that all fires should be immediately notified to the Fire Brigade officials—there having been some delay in this respect on the present occasion.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

When these "Notes" appear in print, the world will have entered upon the last year of the century. I am glad to observe that the "JOURNAL" is not being made a medium of those who preach the foolish notion that the century ends with 1899. To go further might lead to rejoinders; for the subject is one upon which there is a keen conflict of opinion. So I will content myself with the closing year as it has been, without reference to what position it is to occupy in the roll of the ages. In gas matters within the area of Scotland, it has been rather a hum-drum year. It has not been distinguished for anything striking. You can scarcely fix your mind upon any single event and say, "This is notable." It has, nevertheless, been a year of great activity. Increased outputs, many of them unusually large, have been experienced at all the larger works, without exception. The sequel is found in the bustle of making arrangements to meet the ever-growing demand for gas. Entirely new works are in course of erection at Glasgow, Edinburgh, and Perth; practically new works have been completed at Stirling; new works are in contemplation at Falkirk; and North Berwick; large extensions are in progress at Dundee; and extensions were completed at Paisley, Renfrew, Forfar, and other places. All this extra work has been put upon gas managers, who, in addition, have not been free from anxiety upon other subjects—chiefly coal and labour. The price of coal has advanced considerably during the year—main from 9s. 3d. to 11s. per ton; ell from 7s. 3d. to 13s.; and splint from 10s. 6d. to 13s. Though this great increase in the cost of raw material has added heavily to the burden of management, it is fortunate that, as yet, there has been little occasion for raising the price of gas, which, in most cases, remains at what it was a year ago. The labour question has been brought forward by Trades Union interests. When the men were working quite contentedly, the Union officials swooped down upon them, set up branches in different towns, and then proceeded to formulate demands for higher wages. These have been conceded in Glasgow, Edinburgh, Dundee, and Aberdeen; and in the three latter towns no further trouble has as yet been experienced. In Glasgow, however, an effort is being made to compel the Corporation to recognize the Union. Had these elements not developed, the year would have been one of great material prosperity. With them on their shoulders, it is not exaggerating to say that gas managers face the coming year with careful countenances. Not without hope, by any means, for the path is not in any particular downwards. It is still upwards; and if there should be a curtailment of the business conducted by gas undertakings during 1900, the gas industry will not stand alone, for the great task which the nation has set itself in South Africa will undoubtedly lead to the practising of economies in many walks of life.

There has been nothing of the nature of an organic change in gas production or use during the year. There has been no new installation of carburetted water gas, which is now only used in Edinburgh. Neither has acetylene gas fared well. It has been abandoned at Cowdenbeath; and at Portsoy, the only other place where it was adopted for public use, there have been difficulties of a financial nature, which, I rather think, have not yet been surmounted. Coal gas is thus more than holding its ground. In the burning of it, there has been a great extension of the incandescent system, but nearly altogether for private lighting. The slow rate at which public bodies have adopted it is amazing.

Transfers were completed at Peebles, Troon, and Helensburgh; and the preliminary steps for a transfer have been taken at Dunoon.

Gas Companies have been registered under the Companies Acts at Barrhead, Strathaven, Annan, Saltcoats, and Newport (Fife). At the latter place, the Company have taken power to supply electricity.

In the electric lighting world, Paisley is the only place of note where a new installation has been completed. Negotiations are being carried on, or works are in progress, for its introduction into Stirling, Brechin, and Montrose; but there does not appear to be much heart in the work.

There have been a good many changes among gas managers. Mr. George Keillor, jun., was transferred from Assistant at Hamilton to be Manager at Peterhead; Mr. Peter B. Watson was transferred from Castle Douglas to Stranraer; Mr. P. R. Chalmers, of Coupar Angus, received the appointment at Castle Douglas; Mr. A. Smith was appointed Manager at Airdrie, but after three months resigned on account of ill-health, and Mr. D. Vass, of Portobello, was appointed in his place; Mr. W. Blair was transferred from Haddington to Helensburgh, and was succeeded at Haddington by his brother, Mr. Peter Blair, of Blaenau Festiniog; Mr. S. G. M'Lusky was appointed Manager at Coldstream; Mr. A. M. Canningham, at Kilmalcolm; Mr. J. Walker, of Edinburgh, at Comrie; Mr. John O'Neill, at Cumnock; Mr. James Kay was promoted from Assistant to be Manager at Elgin; Mr. J. W. Napier was transferred from Auchterarder to Carnoustie; Mr. James Dawson, from West Calder to Auchterarder; Mr. C. Winton, from Comrie to West Calder; and Mr. W. M'Lean Ross succeeded his father at Stonehaven.

The obituary list is, happily, short. It includes the names of Mr. W. Taylor, of Elgin, Mr. Patrick O'Neill, of Lochmaben, and Mr. Graham Ross, of Stonehaven. Mr. D. Bruce Peebles, of Leith, who held a distinguished position in the world of gas supply, was also recently removed by death.

Mr. J. Burgess, of the Gas Workers' Union, has published another letter in the "Glasgow Herald," in reply to that signed "A Ratepayer," dealing with the proposed establishment of a Conciliation Board in Glasgow. Mr. Burgess reaches the conclusion that "the hands may be the hands of 'A Ratepayer,' but the voice is the voice of Mr. George Livesey." This is interesting, whatever meaning may be put upon the words—and they are capable of more than one interpretation. But the consolation which Mr. Burgess takes out of them is curious: One advantage to them is "that the worst that can be said of this Union has now been said." The species of pleading indulged in, is shown by the passage in which he says: "The point before us is not what this Union did, or proposed to do, or was alleged to attempt, ten years ago, but what it proposes to do to-day. I always understood that past character was of more value in forming an estimate as to uprightness than is present profession; but Trade Unionists of this stamp seem to act upon principles which differ from those by which other people are guided. Then the writer speaks of the present system of managing the gas undertaking as an "autocracy." The Managers are the masters of the situation. Thence arises a great deal of the friction in our Corporation Gas-Works—friction which it is the object of this proposal to remove—that those who

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 19.

Issue.	Share.	When Div.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	21—22	..	4 15 5
100,000	10	"	7½	Do. 7 p. c.	14½—15½	..	4 16 9
300,000	100	July 3	5	Australian 5 p. c. Deb. .	102—104	..	4 16 2
200,000	5	Nov. 15	6	Bombay, Ltd.	5¾—6¼	..	4 8 11
40,000	5	"	6	Do. New, £4 paid .	4—4½	..	5 6 8
880,000	Stk.	Aug. 16	12	Brentford Consolidated	273—278	..	4 6 4
270,000	"	"	9	Do. New	210—215	..	4 3 9
50,000	"	"	5	Do. 5 p. c. Pref. .	140—145	..	3 9 0
159,375	"	Dec. 14	4	Do. 4 p. c. Deb. .	124—128	..	3 2 6
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig. .	250—260	..	4 8 6
226,320	"	"	8½	Do. A. Ord. Stk. .	183—188	..	4 10 5
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max. .	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43½—44½	..	4 9 10
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c. .	25—27	..	4 8 11
75,000	10	"	9	Do. 7 p. c. . . .	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	8½—9	—½	6 13 4
220,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb. .	98—100*	..	4 0 0
150,000	20	July 13	8½	Cagliari, Ltd. . . .	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock .	305—310	..	4 7 1
200,750	"	"	10½	Do. New do. .	240—245	..	4 5 9
200,750	"	Dec. 14	4½	Do. 4½ p. c. Deb. .	140—145	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181	..	4 19 5
200,000	"	"	7	Do. 7 p. c. Pref. .	178—183	..	3 16 6
51,600	Stk.	Aug. 31	14	Croydon A 10 p. c. . .	335—340	..	4 2 4
168,400	"	"	11	Do. B 7 p. c. . .	265—270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	130—135	..	3 17 9
60,000	"	"	5	Do. 5 p. c. Pref. .	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd. . . .	21—22	..	5 0 0
354,060	10	"	11	Do. £7 10s. paid .	15½—16½	..	5 0 0
14,993,075	Stk.	Aug. 16	4 1/0	Gas- 4 p. c. Ord. . .	104—106	+1	4 12 5
2,600,000	"	"	3½	light 3½ p. c. max. .	97—99	..	3 10 8
3,799,735	"	"	4	and 4 p. c. Con. Pref.	119—122	..	3 5 7
3,993,975	"	Dec. 14	3	Coke 3 p. c. Con. Deb.	96—98	..	3 1 3
70,000	10	Nov. 15	8	Hongkong & China, Ltd.	13¼—14½	..	5 10 4
3,800,000	Stk.	Nov. 15	10	Imperial Continental .	212—217	—1	4 12 2
473,600	Stk.	Aug. 16	3½	Do. 3½ p. c. Deb. Red.	101—104	..	3 7 4
75,000	5	Dec. 14	6	Malta & Medn., Ltd. .	5—5½	..	5 9 1
560,000	100	Oct. 2	5	Met. of 5 p. c. Deb.	110—114	..	4 7 9
250,000	100	"	4½	Melbourne 4½ p. c. Deb.	107—109	..	4 2 7
541,920	20	Nov. 15	3	Monte Video, Ltd. . .	11—12	..	5 0 0
617,946	Stk.	Aug. 31	9½	Newc'tle & Gatesh'd Con.	220—225	..	4 2 3
264,855	Stk.	Dec. 29	8½	Do. 8½ p. c. Deb. .	104—107*	..	3 5 5
60,000	5	Sept. 29	7	Ottoman, Ltd. . . .	5¼—5¾	..	6 1 9
					*Ex div.		

Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd. . . .	7—7½	..	5 6 8
135,000	5	"	8	Do. New, £4 10s. pd.	6½—6¾	..	5 6 8
15,000	5	"	8	Do. do. 1879, £1 pd.	1¼—1¾	..	4 11 5
500,000	100	Dec. 1	6	People's Gas 2nd Mtg. of Chicago Bonds.	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord. . . .	10½—11	—¼	6 7 3
250,000	Stk.	Dec. 29	4	Do. 4 p. c. Deb. .	98—100*	..	4 0 0
250,000	10	Sept. 15	10	San Paulo, Ltd. . . .	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.	247—249	..	4 0 4
209,053	"	"	10	Do. B.	247—249	..	4 0 4
447,427	"	"	10	Do. C.	247—249	..	4 0 4
5,600,000	Stk.	Aug. 16	5⅓	South Metrop., 4 p. c. Ord.	133—136	+1	3 18 5
1,520,000	"	July 13	3	Do. 3 p. c. Deb. . .	101—103	..	2 18 3
120,000	Stk.	Aug. 31	6	Tottenham A. 5 p. c. and B. 3½ p. c.	141—143	..	4 3 11
250,520	"	"	4½		102—104	..	4 6 6
55,100	"	Dec. 14	4	Edmonton 4 p. c. Deb..	113—117	..	3 8 5
182,380	10	June 15	5	Tuscan, Ltd.	9—10	..	5 0 0
149,900	10	July 3	5	Do. 5 p. c. Deb. Red.	98—100	..	5 0 0
				WATER COMPANIES.			
746,184	Stk.	Dec. 29	11	Chelsea, Ord.	£05—310*	..	3 11 0
150,000	"	"	5	Do. 5 p. c. Pref. .	157—162*	—½	3 1 9
160,000	"	"	4½	Do. 4½ p. c. Pref. '75	140—145*	+¼	3 2 1
175,785	"	Sept. 29	4½	Do. 4½ p. c. Deb. .	148—153	..	2 18 10
1,720,560	Stk.	Oct. 13	7	East London, Ord. . .	200—205	..	3 8 4
654,740	"	Dec. 29	4½	Do. 4½ p. c. Deb. .	145—150*	—3½	3 0 0
390,000	"	"	3	Do. 3 p. c. Deb. .	98—100*	—½	3 0 0
700,000	50	Dec. 14	7½	Grand 10 p. c. max. .	107—109	..	3 8 10
810,000	Stk.	Sept. 29	4	Junction 4 p. c. Deb. .	131—136	..	2 18 10
708,000	Stk.	Aug. 16	14	Kent	348—353	..	3 19 4
160,000	"	"	7	Do. New, 7 p. c. max. .	200—210	..	3 6 8
1,043,800	100	Dec. 29	10½	Lambeth, 10 p. c. max. .	290—295*	..	3 11 2
406,200	100	"	8	Do. 7½ p. c. max. .	215—220*	—1¼	3 12 9
850,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb. .	135—138	..	2 18 0
500,000	100	Aug. 16	13½	New River, New Shares	428—433	..	3 2 4
1,000,000	Stk.	July 28	4	Do. 4 p. c. Deb. .	133—138	..	2 18 0
902,300	Stk.	Dec. 14	7½	South- Ord. . . .	303—308	..	3 12 1
126,500	100	"	7½	wark 7½ p. c. max..	190—195	..	3 16 11
489,200	Stk.	"	5	and 5 p. c. Pref.	160—165	..	3 0 7
1,019,585	"	Oct. 13	4	Vauxhall 4 p. c. A Deb.	131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	10	West Middlesex . . .	290—295	..	3 7 9
200,000	"	"	4½	Do. 4½ p. c. Deb. .	147—152	—3	2 19 3
200,000	"	Sept. 15	3	Do. 3 p. c. Deb. .	100—102	—1	2 18 10

labour for the Corporation in the various departments may do so with the greater confidence because of the consciousness that if an attempt be made to wrong them they have always a court of appeal open for the redress of their grievances. What impertinence! Where is the evidence of any attempt ever having been made to wrong anyone? And what are the grievances that are spoken of? If there are any wrongs or grievances, the columns of the "Glasgow Herald" are open for their exposure; and there could be no better way of suppressing them. Publicity would be far more effectual than any Conciliation Board. Mr. Burgess cannot be ignorant of this; but, of course, if wrongs were righted without the intervention of the Union, where would the Union come in? Which would make it appear that it is the good of the Union which is sought, and not alone the good of the workpeople.

Extensions at the works of the Renton Gas Company having been completed, they were formally brought into use on Wednesday, when gas was turned on to a new holder by Mr. R. Ritchie, the Chairman of the Company. The new holder increases the storage capacity at the works from 28,000 to 114,000 cubic feet. It is a wire-rope guided holder, built by Messrs. Ashmore, Benson, Pease, and Co., Limited. Besides the holder, a new station governor and a new engine and exhauster have been placed in the works; and 2000 yards of new mains have been laid, 8-inch pipes having been substituted for 4-inch ones. The whole of the work has been carried out under the supervision of Mr. W. White, the Gas Manager.

The Corporation of Helensburgh, having been judicially barred from placing a new gasholder where they desired, have resolved to erect it upon ground which they already possess, beside the gas-works. The new holder is to be of 200,000 cubic feet capacity. Had a neighbouring proprietor consented to sell a piece of ground adjoining, a more complete scheme could have been adopted; but he absolutely declined to part with his property.

After much agitation, some of it of a not very courteous nature, Mr. Forbes Waddell has succeeded in getting the storage accommodation for gas put upon a satisfactory footing in the Forfar Gas-Works. The new holder, which has been erected for the Corporation by Messrs. Henry Balfour and Co., Limited, to plans prepared by Mr. Waddell, was inaugurated on Monday. Provost M'Dougall, at the opening ceremony, said that they had been afraid to go into such expenditure as this, because of the outcry about the electric light; but, though the electric light had been introduced into the factories in Forfar, the demand for gas had gone on increasing. It had risen, within the past few years, from 27 to 32 million cubic feet per annum. They were now convinced that the electric light would not hurt their gas undertaking. The gas was turned on to the new holder by Bailie Hanich, the Convener of the Gas Committee. Thereafter Provost M'Dougall expressed the indebtedness of the Gas Corporation to the community for the patience they had displayed during the past few weeks. The Manager, he said, had had a great task to supply the town with gas, and had only been able to do so by lowering the pressure. The company were entertained by the Gas Corporation; and some speaking followed, in which Mr. T. D. Hall, of Montrose, and Mr. C. P. Myers, of Kirriemuir, took part. The new holder has cost about £4000. It is of 150,000 cubic feet capacity, and has taken the place of an old and worn out 25,000 cubic feet holder. There is another holder in the works of 86,000 cubic feet capacity. The maximum daily make is 200,000 cubic feet; while there is now storage accommodation for 236,000 cubic feet. Mr. Waddell thus finds himself lifted from a position of having storage for 89,000 cubic feet less than his maximum daily output, into one of having a surplus of 36,000 cubic feet. He has had a struggle to get it; but now it has been obtained, he should have an easier mind. It may be said that, till now, Mr. Waddell has never, since he went to Forfar, had the opportunity of working on anything like favourable lines.

Much is being written at present about a threatened coal famine. Without doubt, coal is scarce; and the customary policy when this state of matters arises has been adopted, of blaming the railway companies for the short supply of waggons. This is nonsense. The railway companies in 1898 handled more than 700,000 tons of coal for shipment above what they did in 1899—which is equal to 122,000 waggon journeys—and there was no complaint to speak of upon the score of the waggon supply. The present condition of the market is altogether artificial. For the cause of it, more than one reason may be assigned. Probably the most powerful one is the war. Were it over, there would be a heavy fall in prices. Probably the fall may take place before peace is secured; for there is nothing which plays such havoc with trade as war does. It is almost a certainty that coal will not be quite so cheap in 1900 as it has been in 1899; but present prices cannot be anything like maintained. Coalowners who have large unsold stocks may be overtaken by the fall before they can realize; and I quite expect that some of the more knowing ones are already selling out as fast as they can—being content with the rise which they have obtained. Were it possible to establish this, the avalanche would at once follow.

December has been a month of great darkness. The sun has scarce'y shone in it; and the clouds have been heavy. In addition to darkness, there has been fog in Glasgow and the West of Scotland. Gas consumption has consequently been very heavy. Wednesday was a foggy day in Glasgow; and the consumption of gas reached the total of 33 million cubic feet, which is looked upon as the greatest quantity of gas ever sent out in one day. The resources of the undertaking were taxed to their utmost to keep up the supply. Work of this sort is not satisfactory to anybody; and already one man has written to the newspapers complaining that the want of gas interferes with the operations of gas-engines and the use of gas-fires. The new works at Provan should make matters right in this respect.

At Troon, a defect at the gas-works has led to a scarcity of gas; and the Gas Commissioners have issued a circular to consumers, asking them in the meantime to economize in the use of gas as much as possible.

A Company has been formed with a capital of £100,000, in £1 shares, to acquire certain inventions of Mr. F. W. Lanchester relating to gas and oil engines, &c.

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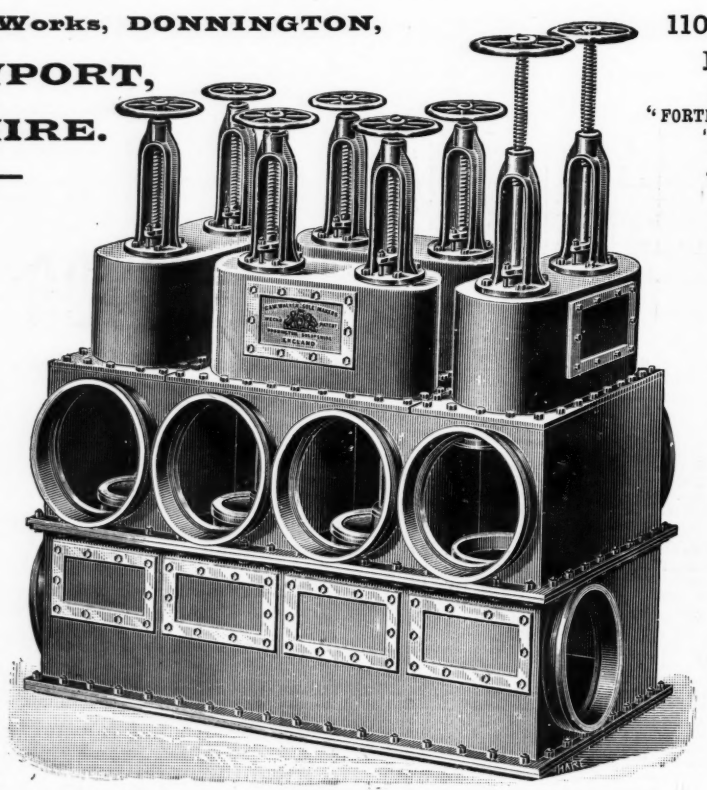

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CONDENSERS.
VALVES.
TAR-BURN ERS.

Weck's Patent Centre-Valve for Four Purifiers.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 30.

Sulphate of Ammonia.—The business of the week has been quite of a holiday character; and parcels offering have not been easily disposed of. The closing quotations are £10 18s. 9d. to £11 2s. 6d. per ton delivered f.o.b. at the ports. Inland transit on the Continent is still interrupted; and this has not only permitted, but necessitated, the postponement of shipments, so that demand has become sluggish. In the forward position, there has been more inquiry; and buyers' views being much below those of makers, any selling done has been of a speculative character.

Nitrate of Soda is steady on spot at 8s. per cwt. for good, and 8s. 1½d. for refined, quality; and for cargoes, values are barely maintained.

LONDON, *Dec.* 30.

Tar Products.—Very little new business is reported. Ninety per cent. benzol continues flat; but for 50's there is a little better inquiry. The position of benzol is somewhat remarkable, as notwithstanding the enormously increased production, makers state that they hold no stocks; while it is well known that users have not stocked latterly. There is again some inquiry from the Continent, which is encouraging, having regard to the fact that very little benzol has been sent abroad for some time. Toluol is steady, solvent naphtha is strong, crude naphtha is weak, and heavy naphtha is firm. Creosote is reported slightly weaker; but makers are well sold, and in some instances oversold. Heavy oils are somewhat scarce, and command better prices. Pitch is dearer, with inquiries for spring delivery. Crude naphthalene is stronger. Anthracene is weak, with no inquiry.

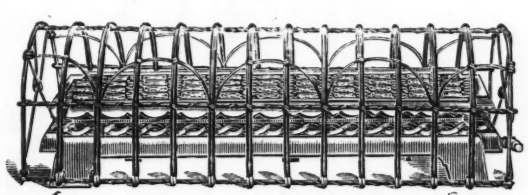
Prices obtaining during the week are: Tar, 16s. 6d. to 25s. 6d. Pitch, east coast, 34s.; west coast, 31s. 6d. Benzol, 90's, 8d.; 50's, 11d. Toluol, 90 per cent., 1s. 3½d.; pure, 2s. 2d. Solvent naphtha, 1s. 4d.; crude, 30 per cent., naphtha, 4¾d.; heavy naphtha, 1s. 3½d. Creosote, 3¼d. Heavy oils, 3½d. to 4d. Carbolic acid, 50's, 2s. 6d.; 60's, 2s. 9d. Crude naphthalene, 55s. Anthracene, "A," 3¾d.; "B," 2½d.

Sulphate of Ammonia does not improve; and it is doubtful whether the position to-day is quite as strong as it was a week ago. Owing to the holidays, very little business has been done, and quotations are more or less nominal. For prompt delivery, £11, less 3½ per cent., is asked; and for forward delivery makers quote at least 5s. more.

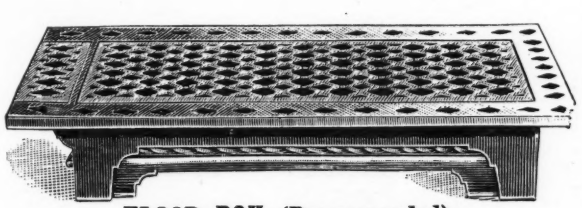
In recognition of old employees' long and faithful services, Mr. John Gwynne, the head of the firm of Messrs. J. & H. Gwynne, Limited, of the Hammersmith Iron-Works, has just assigned to them 1000 fully-paid-up shares in the Company. The participants number nearly forty. According to the deed of gift, the dividends are to be divided, and paid half yearly. The only conditions imposed are that the men shall continue working for the firm unless incapacitated by illness or accident, and that upon the death of a participant his relatives shall have no claim.

THE LANCASHIRE COAL TRADE DURING 1899.

The coal trade of this district has during the past twelve months experienced a period of greater prosperity than has been known for a very considerable number of years. With the exception of the better classes of round coal (the demand for which has perhaps been below the average—partly as a result of the exceptional mildness of the winter seasons and the prolonged and exceedingly hot summer, and partly owing to the largely increased introduction of gas cooking and heating appliances), all descriptions of fuel have been in pressing request for iron-making, steam, and general manufacturing purposes, with supplies for the most part short to meet the requirements of consumers. Even house-fire coals have not been at all plentiful; and any surplus output has been required to replenish the very low stocks held at collieries, with the result that pits worked much less short time in the summer than usual, and prices during the twelve months have been advanced about 1s. 4d. to 1s. 6d. per ton—the comparative quotations at the opening and the close of the year being as follows: Opening rates: 12s. to 12s. 6d. per ton at the pit for best Wigan Arley, 10s. 6d. to 11s. for Pemberton four-feet and seconds Arley, and 9s. to 9s. 6d. for common house coal. Closing rates: 13s. 4d. to 13s. 10d. per ton for best Wigan Arley, 11s. 8d. to 12s. 6d. for Pemberton four-feet and seconds Arley, and 11s. for common house coal. The exceptional activity throughout the iron, engineering, and in fact all the principal coal-using branches of industry, has naturally brought the greatest pressure of demand upon the lower qualities of round coal, and on all descriptions of slack, supplies of which have been inadequate to meet requirements. Common round coals, for steam and forge purposes, have advanced quite 2s. per ton; pit prices, which in January averaged about 8s. 6d. to 9s. per ton, having risen to 10s. 6d. to 11s. On steam coal for shipment there has been a similar upward move, averaging about 3s. per ton; prices rising from 9s. 6d. per ton in January, to 12s. 6d. in December, delivered at the ports on the Mersey. Engine fuel, of which there has been an absolute scarcity of supplies, has advanced something like 75 per cent., and this, coupled with a previous advance of 40 to 50 per cent., makes a total upward move approaching 125 per cent. upon the minimum figures ruling during the period of depression in the coal trade. Slack, which in January was quoted at 4s. 6d. per ton at the pit for common, 5s. for medium, and 6s. for best sorts, has by successive advances risen to 7s. 6d. per ton for common, 8s. 6d. for medium, and 9s. 6d. for best qualities; and even at the maximum figures, collieries, as a rule, have only comparatively limited supplies for their regular customers, with nothing to offer in the open market, where all sorts of prices are ruling to outside buyers, who have to purchase as best they can. This exceptional state of things, especially as regards the pressing demand for the lower qualities of round coal, has necessarily strengthened the position of collieries with respect to the usual contracts for gas coal and locomotive fuel; and they have not been slow to take full advantage of the situation. With the object of counteracting, not only the competition of local collieries, but also that from Yorkshire and other districts, which in previous years



"CORRIDOR" STOVE.



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has tended very considerably towards keeping down the contract prices for gas coals, the Lancashire and Yorkshire coalowners early on in the year opened up negotiations with a view to some co-operation with regard to the prices that should be quoted when the gas coal contracts came upon the market. This resulted in an understanding as to some uniform course of action; and eventually an arrangement was mutually come to that when the usual tenders for gas coal were asked for, these should not in any case be sent in at less than 1s. 6d. per ton above the prices accepted in 1898—many of the coalowners expressing a determination to hold out for an advance of 2s. This firm position taken up by the coalowners, and the general indications of the market, which all pointed to the probability of prices being still higher as the year progressed, brought buyers of gas coal on the market at an earlier period than usual; and contracts were not only settled with unusual promptitude, but in most cases to cover the full requirements of consumers, who in previous years had generally left over small quantities to be bought subsequently, as any favourable opportunity in the market might arise. It was, however, only too evident that during the current year no advantage was to be gained by waiting, and that if extra quantities had to be bought later on, it was more than possible they would only be obtained at still higher prices than those at which the contracts were placed. The arrangement which had been come to by the Lancashire and Yorkshire coalowners was firmly adhered to throughout; and no contracts were concluded except at an advance of 1s. 6d. per ton over the previous year's rates, while in some special cases collieries obtained an advance of as much as 2s. The average basis of prices at which contracts were placed ranged from about 9s. and 9s. 3d. per ton at the pit for the lower descriptions, to about 9s. 6d. and 10s. for the better qualities of gas coal, as compared with 6s. 9d. to 7s. for the lower qualities and 7s. 9d. to 8s. for the best gas coals in 1898. The Lancashire and Yorkshire coalowners also came to a similar arrangement with respect to the locomotive fuel contracts, which they mutually agreed should not be entertained except at an advance of 1s. 6d. per ton over the previous year's rates. The railway companies for a time held aloof from placing their contracts; and in one instance an attempt was made to break through the arrangement by offering to contract at 1s. 3d. over the previous year's rates. But collieries held firmly to the position they had taken up; and the railway companies had ultimately to accept the coalowners' terms. The bulk of the contracts were eventually placed on the basis of 8s. per ton at the pit for locomotive fuel, as against 6s. 6d. in 1898; while in one or two instances, where railway contracts were not settled till later on in the year, an advance of 2s. had to be paid to secure supplies. The coke trade has also been exceptionally active during the year; and with not only the high price, but also the scarcity of slack, which has prevented a large number of ovens being put in, prices have gone up about 10s. per ton during the twelve months; ordinary furnace cokes, which in January could be bought at 14s., having been advanced to 23s. and 24s., and foundry cokes have risen from 20s. up to 29s. 6d. and 30s. at the ovens. A noteworthy feature of the year in the coal trade has been the absence (excepting a short-lived dispute with the engine winders, which was amicably settled) of any of the labour and wages troubles which almost invariably come to the front during any period of special activity in trade. This, so far as the miners are concerned, is no doubt due to the continuance of the Conciliation Board, who have regulated wages without any approach to friction; and under this arrangement the miners have received an advance of 7½ per cent. during the year. Whether the Conciliation Board will finally be renewed on the terms which have been conditionally agreed to, would perhaps seem rather doubtful, as many of the miners are strongly objecting to it. It is, however, to be hoped that some means may be found for securing to the trade a similarly satisfactory relationship between the coalowners and the miners in the future. The coalowners themselves have also taken advantage of the exceptional position of trade. A Coal Sales Association has been formed for regulating prices, and has taken the extraordinary step of declining to contract with merchants at any stipulated prices, but only for deliveries of stipulated quantities; the prices to be fixed when deliveries are made, in accordance with whatever may be the then current market rates. That such terms as these have been strongly opposed by merchants, can be readily understood; and comparatively few contracts have been entered into under the above conditions. The Lancashire coke manufacturers have also formed an Association which during the year has met periodically to regulate prices, and settle the advances that were to be made.

COAL TRADE REPORTS.

From Our Own Correspondents.

Northern Coal Trade.—The coal trade is very busy; and the interruption to the production by holidays has made fuel scarcer than ever, and in some cases has raised the prices. Best Northumbrian steam coals vary from 15s. to 15s. 6d. per ton f.o.b., and steam smalls are from 8s. 6d. to 9s. Demand is full; and some of the collieries cannot guarantee delivery for a fortnight. In regard to gas coal, most of the deliveries that are being made are on old contracts, some of the heaviest of which have three months or more to run yet, and which are on comparatively low prices. These deliveries are so large that they take up most of the coal that is being produced. For the small quantities that are beyond these contracts, about 15s. per ton f.o.b. is asked, and has on one or two occasions been paid. Manufacturing coals are steady, without change in the prices. Gas coke is in good demand; and the large output is well taken up. Prices vary considerably, so that actual quotation is difficult.

Scotch Coal Trade.—Trade in coal is perhaps best described as in a state of expectancy. It is quite manifest that owners are holding up for a rising market. There has already been an increase in prices, in some instances to the extent of about 40 per cent. The expectation is common that there will be a still further rise; and, in the meantime, it has been resolved to give out no quotations, but to sell at what can be secured. Last week the prices obtainable were: Main 11s. to 11s. 6d. per ton f.o.b. Glasgow, ell 13s. to 14s., and splint 13s. to 14s.

The "CZARINA."

Season 1899-1900.

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Complaints as to the Quality of Manchester Gas.—At the last monthly meeting of the Moss Side District Council, it was resolved to send a letter to the Manchester Corporation protesting against the present quality of the gas supply. The Chairman remarked on the extraordinarily poor quality of the gas during the previous few days. The light had been no better than that received from a candle. He had wondered whether the Corporation were trying to push the sale of the electric light; but in any case consumers of gas ought to be better treated. Mr. Box said there were a great many complaints from Moss Side ratepayers regarding the gas supply. The quality was so bad that it blackened a new ceiling in twenty-four hours.

The Sanctioning of Payments by Gas Committees.—At a recent meeting of the Cowes District Council, a letter was read from the District Auditor (Mr. O'Neil), stating that when the examination of the gas accounts was completed, he proposed to ask for the Council's sanction to the whole of the expenditure made by the Gas Committee during the year, amounting to £7000. It would, he remarked, be within the recollection of the Council that some of the accounts were not brought before the Council for payment, and some cheques were even signed in private residences, which system could not be passed. After the reading of the communication, Mr. Brown reminded the Council that on several occasions they had blindly sanctioned all the Gas Committee's proceedings up to a certain date. Mr. Fellows, sen., thought the Committee were quite justified in their action. They ascertained what was done in other places, where District Councils had the management of the gas-works; and they acted on the same principle. The Committee had also brought their proceedings before the Council; and they had been confirmed. He moved that a resolution sanctioning all payments made by the Committee be adopted. This was agreed to.

The Bradford Gas-Works in Danger—A fire, attended with a serious loss of property, broke out on the night of the 23rd ult. in the warehouse occupied by Messrs. W. Rouse and Co., spinners and manufacturers, Bradford. The building is an old one five storeys high; and, being well filled with yarn, waste, bobbins, and paper, it burnt with great rapidity. The whole of the old building was entirely destroyed, and the adjoining warehouse, occupied by Mr. E. B. Whitley, dealer in mohair, was also burnt, with its valuable contents. An alarming feature in connection with the outbreak was its close proximity to the purifier-house of the Corporation Gas-Works, in which were six purifiers. The Deputy-Manager (Mr. T. H. Duxbury) was quickly on the spot; and, seeing the position of affairs, he with great presence of mind shut off the purifiers, and allowed the gas in them to go to waste. When the warehouse collapsed, it fell on to the purifier-house, and brought down the roof; the whole of the *débris* dropping on to the boxes, which only a few minutes before were full of gas. Three of them were broken; but, fortunately, nothing more serious happened. Mr. Wood and Mr. Duxbury were able to assure the firemen that they need have no apprehension of danger from the purifiers; and the men therefore mounted them, and brought their hose into play from this position. Their efforts were successful in preventing the flames from reaching a gasholder.

Theft of Electrical Energy.—It may be remembered that on more than one occasion the German Courts have decided that the theft of electrical energy is not punishable by law, according to the existing code, as electric current or electrical energy cannot be considered to be a material object. A Bill to remedy this state of affairs has been laid before the German Federal Council.

Salford Corporation Gas Supply.—Despite the increasing use of electricity in Salford, says a local paper, the consumption of gas steadily advances; the percentage of increase given in the last annual report being equal to 3·11 over 1898. The coal and cannel carbonized during the year amounted to 135,372 tons; and the quantity of gas made was 1,388,186,000 cubic feet, of an average illuminating power equal to 19·24 candles, the parliamentary standard being 18 candles within the borough and 17 candles, as tested in the out-districts. The cost of coal was rather more than in the previous year. The market for residuals had shown improved results for coke and sulphate of ammonia; but the receipts from the sale of tar had been slightly less. The works and plant have been maintained in a thoroughly efficient condition; and the Gas Committee are at present largely increasing the purifying and scrubbing plant. The length of mains is 235 miles; last year it was 231 miles. The prepayment meters actually in use last March numbered 3269; but on the 12th ult. the number was 5444, while for gas-cookers there has also been a most satisfactory demand.

The Shortage of Gas at Halifax.—A representative of a local newspaper recently waited upon Mr. Thomas Holgate, the Engineer of the Halifax Corporation Gas-Works, with the view of ascertaining the cause of the inadequate gas supply during the week or two before Christmas. It may be remembered that the Gas Committee issued a request to the consumers to exercise the greatest economy; and Mr. Holgate explained that the reason for this notice was that the cold weather, combined with fog, came at a time of greatest demand for gas, and the increase in consumption had gone up to an abnormal degree. The only thing the Committee could therefore do was to diminish the pressure until they could increase the stock sufficiently to be able to resume full pressure, which they were anxious to do towards the end of the week before Christmas, so that the tradespeople should not experience any inconvenience in their Christmas displays. By having reserved what little gas they could, they appeared to be through their difficulties. With Halifax being such a hilly town, continued Mr. Holgate, the want of gas was felt only by the consumers who lived on the lower levels, and unfortunately the inconvenience had to fall upon those residing in the town. If, he added, the new carburetted water-gas plant had been in operation, it would have assisted in getting through the strain. The reason it was not ready was that the contractors were behind with their work, owing to having had great difficulty in getting steel and iron from the manufacturers. The editors of the local papers appear to have received many letters complaining of the deficient supply. The electrical service of the borough has also been giving much annoyance; and there was a complete collapse of the lighting on the Corn Market the Wednesday before Christmas.

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Shortage of Gas at Driffield.—The extended use of gas for cooking and heating purposes at Driffield led to such a demand on the works in the week preceding Christmas, that something like a "famine" occurred on one evening, which, unfortunately, was a particularly dark one. The Gas Committee have very wisely decided to extend their plant.

The Proposed Municipalization of the Cambridge Water-Works.—The Bill which the Cambridge Town Council propose to promote in the next session of Parliament to confer upon them several important powers, among others authority to purchase the water-works, was submitted at a meeting of ratepayers last Thursday. There was a vigorous and influential opposition to several of the proposals; and the motion consenting to the promotion of the measure was defeated by a considerable majority. A poll was demanded.

Fire at the Worcester Gas-Works.—About two o'clock last Friday, an explosion occurred in the oil-shed at the Worcester Gas-Works. The structure, owing to the inflammable nature of the contents, was quickly in flames, which threatened to attack the adjacent buildings. By the prompt arrival of the Fire Brigade, the fire was extinguished in about half-an-hour; but everything inside the shed had been destroyed. It seems that the giving way of a joint in the oil-tank allowed oil to escape; and this became ignited.

Lincolnshire Towns in Darkness.—Owing to the non-arrival of coals, and the consequent inability of the Gas Company to manufacture gas, the town of Long Sutton was in darkness on the evenings of the 20th and 21st ult., and remained so for several succeeding ones. The Company have a contract with a Sheffield firm, but were unable to obtain supplies of coal. On the 22nd, one of the Directors sent a ton from his own house in order to make a small quantity of gas. Difficulty has also arisen at Skegness. Owing to their inability to obtain coal, the Skegness Gas Company have not been able to make their usual supply of gas; and in consequence the streets of the town have been in darkness for several nights. Lord Scarborough's agent offered the Company the use of some stored coal, otherwise Skegness would have been in darkness during the whole of the Christmas holidays.

Gas Explosion in Salisbury.—Soon after noon on Wednesday, the 20th ult., a serious gas explosion occurred at the shop of Mr. C. A. Bentlif, brush manufacturer, &c., in Winchester Street, Salisbury, forcing up a large portion of the flooring, and generally wrecking the shop. It seems that Mr. Bentlif had noticed an escape of gas for some days, and had given notice to the Gas Company, who sent a couple of men to put matters right. Outside the shop, the men found a leakage in the service pipe; and, having rectified this, they were testing the joints of the meter, which stood in a small cupboard in the shop, when a violent explosion occurred beneath the flooring. Subsequent examination revealed the cause of the disaster. The service-pipe inside the shop was as defective as the portion which had been repaired outside; and gas in considerable quantity had been escaping from it—filling the space beneath the boards of the floor. The explosive mixture became ignited, with the result stated. Fortunately, the explosion was unattended by personal injury.

A Curious Gas-Stove Explosion in Liverpool.—On Christmas night, a gas-stove in a house in Beaumont Street, Liverpool, exploded, injuring three women. It is stated that the stove became very hot, and water was thrown upon it to cool it, with the result recorded. The women were seriously burnt, and the windows of the apartment were blown out.

Water Supply in Calcutta.—The length of pipes for conveying filtered water in Calcutta now amounts to just over 315 miles. The average daily consumption is 20,684,393 gallons; the estimated daily consumption per head being 34·01 gallons in the town proper, and 19·86 gallons in the added area. The gross cost per 1000 gallons is 2·66 annas. The daily supply of unfiltered water is 4,778,899 gallons; the consumption per head being 10·95 gallons.

Explosion at Burton-on-Trent.—The inhabitants of the northern portion of Burton-on-Trent were greatly startled last Wednesday morning by an explosion caused by a combination of coal and sewer gas. The coal gas had apparently escaped in large quantities, and accumulated in the old sewers in Waterloo and Princes Streets. For the length of a mile, all the manholes, numbering 20, were blown into the air. Several buildings were shaken, and a quantity of glass shattered.

The Award in the Skipton Arbitration.—At the last monthly meeting of the Skipton Urban District Council, the Clerk (Mr. R. Wilson) announced that he had taken up the award of Mr. J. Mansergh, the Umpire in the recent arbitration proceedings respecting the purchase of the gas-works. As mentioned in the "JOURNAL" for the 19th ult., the price is £71,250. Though the award is a good deal more than the Council's offer, the purchase is regarded as satisfactory, inasmuch as it brings into the ratepayers' hands an undertaking which many think should have been acquired years ago.

Opening of New Offices for the High Wycombe Gas Company.—The desire of the Directors of the High Wycombe Gas Company to be in a position to meet all the requirements of the consumers was manifested a few days ago by the opening of their new central offices and showrooms. The premises have undergone considerable improvement, under the supervision of the Manager and Secretary (Mr. J. F. Wicks); and they are now attractive and well adapted for their purpose. The Chairman of the Company (Mr. G. Wheeler), the Directors, and some friends, accompanied by Mr. Wicks, made an inspection of the various burners, fittings, cookers, and gas-fires on view, after which Mr. Wheeler formally opened the premises. He said the Directors believed the step they had taken would very much enhance the appreciation of, and give an impetus to the use of, gas, which had so many advantages over all rival lights in economy, efficiency, and warmth. The Company were a most up-to-date undertaking, inasmuch as they could supply anything from a 1d. burner up to a £1000 gas-engine, if required; and already the manufacturers in the town were availing themselves of their special terms offered for the purchase of gas-engines, the cost of running being about ¾d. per horse power per hour. Mr. Wicks thanked those present for the congratulatory remarks they had made with regard to the general arrangement of the show-room; and stated that it was the intention of the Board to start practical cookery lectures.

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HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000

And Additional Work, including complete Gas-Works at Nelson and Rossland, British Columbia.

Additional Storage at the Cranleigh Gas-Works.—Messrs. Westwood and Wrights will shortly commence erecting at the Cranleigh Gas-Works a new gasholder which they are constructing to the designs of the Company's Engineer, Mr. F. S. Cripps, Assoc.M.Inst.C.E., who has recently remodelled the works. The tank is a concrete one, having wrought-iron bands embedded in it; and the interior is rendered water-tight with portland cement. It is being built locally to designs by Mr. Cripps.

The Water Famine in the Black Country Last Summer.—A letter was read on Wednesday, at the monthly meeting of the Tipton district Council, from the Town Clerk of Dudley, stating that the Local Government Board had replied to a resolution passed at a meeting of representatives of Local Authorities to request the Local Government Board to hold an inquiry with respect to the water famine last summer and the supply by the South Staffordshire Water Company. The Board replied that they had carefully considered the matter, and having regard to the Company supplying the water under parliamentary powers, they were not able to intervene.

Companies Wound Up During the Past Year.—The "Financial News" published yesterday a list of the companies wound up during the past year. It shows that the Acetylene Gaslight, Power, and Calcium Carbide Company, the Acetylene Trust Company, and the Nernst Lamp Company were wound up voluntarily; that the New Incandescent (Sunlight Patent) Gas Lighting Company, the Kent Collieries Corporation, the Kent Coal Finance and Development Company, the Kent Coal Exploration Company, and the Mid-Kent Coal Syndicate were wound up voluntarily with a view to continued existence in another form; and that the Compressed Gas Company, Patent Gas Enrichment Syndicate, and British Gas Traction Company were wound up by order of the Court.

Record Gas Consumptions.—Reference was made in the "JOURNAL" last week to the time of stress through which the Gas Committee of the Birmingham Corporation had been passing; their output of gas in the week ending the 14th ult. being 185½ million cubic feet—11 millions more than the previous highest weekly delivery. It was thought that the consumption in the succeeding week would not show any very great increase on the above figures; but, as a matter of fact, the output reached 197,589,000 cubic feet—a rise of 12 millions, in round numbers. On Thursday, the 21st ult., the consumption of gas in Bradford was a "record" one; the quantity sent from the works being 10,626,000 cubic feet. The previous highest consumption occurred on a very dark day in 1895, when the figures were 10,272,000 cubic feet. Last Wednesday, according to the "Manchester Courier," was "a day to be remembered for darkness out of doors;" and the consumption of gas in the city amounted to 26 million cubic feet. This is the largest figure ever recorded; the normal daily consumption in Manchester in winter being nearly 22 millions. On the same day, the consumption of gas at Rochdale was the heaviest on record; the output being no less than 3,089,000 cubic feet. The nearest approach to this high figure was on the 15th of last month, when 3,011,000 cubic feet were consumed. This was the first time the quantity sent out in 24 hours had exceeded 3 millions.

Mansfield Water Supply.—Lieut.-Col. A. C. Smith held a Local Government Board inquiry at the Town Hall, Mansfield, last Thursday, into the application of the Mansfield Corporation for power to borrow £1415 for water supply. The Deputy Town Clerk (Mr. J. H. White) stated that the estimated population of the town was upwards of 20,000, and the annual assessable value £56,700. The balance of debts outstanding was £90,773, including loans sanctioned, and not yet raised. Mr. F. W. Hodson, of Loughborough, stated that the Corporation had recently completed entirely new works for water supply. In 1892 a loan of £25,000 was sanctioned by the Local Government Board; and on the 10th of July, 1894, an additional sum of £2200 for the purpose of substituting larger mains for those in existence and providing better machinery was also raised. Subsequently there was a further inquiry to raise money for an auxiliary pumping-station, and the Board sanctioned the borrowing of £5000; making the total sum raised £32,200. The works were now all completed, and had proved quite satisfactory; the net cost being £30,639, which was a saving of £1437 on the accepted tenders. The gross cost was £33,443, or £1243 in excess; and to cover this amount, they asked permission to borrow £1250. The reason of the excess was the gradual increase in the cost of labour and building material after the time the tenders were accepted. There was no opposition to the application.

Gas Poisoning Case at Plymouth.—Another case of gas poisoning has occurred at Plymouth. On the night of Friday, the 22nd inst., a sailor in the Royal Navy named George Abbot and a girl of loose character named Mary Wright went to a house in Summerland Place. Next morning they did not get up; and on the bedroom being entered, they were found to be unconscious, and the room was full of gas. The girl was dead; but a policeman and a doctor applied artificial respiration in the case of the man, and he recovered. At the inquest last Thursday, Abbot stated that he sat up in bed to turn the gas down, and it went out. He procured a box of matches to light it again; but Wright took it from his hand, and he went to sleep. The tenant of the house stated that the gas was lowered at the meter, but not turned off. The policeman who examined the gas-bracket found that the tap was loose; and though it was not defective, it was possible that Abbot pulled it over and turned the gas on again. A verdict of "Accidental death" was returned.

Messrs. Biggs, Wall, and Co. have received an order for four of their "Rapid" charging-machines from the Newport (Mon.) Gas Company.

At the annual dinner of the staff of Messrs. R. & A. Main, Limited, of Glasgow, which took place on the 22nd ult., "The Absent-Minded Beggar" was read, after which the sum of £7 6s. 3d. was subscribed by those present for the Glasgow War Fund.

Under the title of Glenfield and Kennedy, Limited, a Company has been registered in Edinburgh, with a capital of £325,000, in £10 shares, to adopt an agreement with the Liquidators of the Glenfield Company, Limited, and Kennedy's Patent Water-Meter Company, Limited.

The Local Government Board Auditor (Mr. Dolby) last Thursday intimated his intention to surcharge individually the Merthyr Guardians in respect of out-relief granted to ironworkers and colliers employed at the stoneyards during the great strike of 1898. It is reported that the amount of the surcharge will be £6709.

Messrs. W. Wilson and Co., of the Lilybank Boiler-Works, Glasgow, in their report for the past year state that this period was marked in the dry-sand and cast-iron pipe trade by a steady demand for all sizes of pipes. Every town of any importance seemed to have been increasing its water or gas works mains. The foreign demand had also been considerable; large orders having been placed for South America, India, Africa, Japan, and Russia.

A serious explosion occurred at the Middlesbrough chemical works of Messrs. S. A. Sadler and Co., Limited, last Wednesday morning; but, fortunately, though several men were working in the immediate vicinity, none of them were injured. A pitch-cooler which had been under repair was brought into use. Boiling pitch was poured into it, when the explosion at once occurred, splitting the cooler to pieces and scattering lumps of metal in all directions. One workman, when the accident occurred, had the presence of mind to turn off the pitch, and thus undoubtedly prevented a great conflagration. It is supposed that some matches or other foreign matter had been left in the cooler, which would, when the boiling pitch was poured in, cause an explosion.

We have received from the Gas-Meter Company, Limited, a tastefully prepared catalogue of the meters and other gas appliances which they manufacture, and for the excellence of which they have obtained a world-wide reputation. The Company's association with the manufacture of meters has been an exceptionally interesting one; they having from the very first manufactured the instrument bearing the honoured name of Croll. The faith which engineers placed in that meter at the beginning has not by any means abated; on the contrary, in its improved form its establishment in the gas world continues to be strengthened year by year. The catalogue is illustrated by close upon 150 excellent engravings, showing the Company's most improved types of wet and dry meters, test meters and holders, motive power and air meters, station meters, governors, pressure registers and gauges, street columns, lanterns, and meters, water and gas fittings, thermometers, and ordinary and special indices. This list only partly indicates the wide range of gas-works requisites manufactured by the Company. Two of their specialities are the "mutual" automatic meter and the Valon prepayment meter; and the illustrations of these are accompanied by an extended description. A commendable feature of the catalogue is that it presents in concise form the exact nature of the Company's productions, and is not interlarded by a mass of extraneous matter which is wearisome to the business man.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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SPECIAL FIRE CEMENT, OXIDE PAINTS OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

SADLER & CO., Ltd., Middlesbrough,
Tar Distillers and Tar Colour Manufacturers.
BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

CANNEL, COAL, ETC.
JOHN ROMANS & SON, EDINBURGH,
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to
No. 30, ST. ANDREW SQUARE, EDINBURGH,
NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."
[For Illustrated Advertisement, see p. 2]

SULPHURIC ACID for Sale.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SHEFFIELD CHEMICAL COMPANY, LIMITED.
BUYERS of Spent Oxide. Sellers of OXIDE OF IRON and SULPHURIC ACID.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

SPECIAL PAINT FOR GAS-WORKS.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1769.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PATENTS FOR INVENTIONS.
Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

SPENT OXIDE wanted.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BENZOL, specially made for the Enrichment of Gas.
ELLISON AND MITCHELL, LIMITED, Kilnhurst, near ROTHERHAM.

ENRICH your Gas with cheap Benzol. Specially prepared, free from sulphur. At to-day's Price of Benzol, ILLUMINATING POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.
Apply to SADLER AND CO., MIDDLESBROUGH.

GAS TAR wanted.
BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PRACTICAL RETORT SETTERS.
BATES & NUTTALL, 32, Havelock Road, Saltley, Birmingham.
Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

SULPHATE OF AMMONIA SATURATORS.
JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.
Before placing Orders, please write for Estimate.
Telegraphic Address: "SATURATORS, BOLTON."

DRAUGHTSMAN (age 23) open for Engagement. Six-and-a-half Years with Contracting Gas Engineers. Also had experience as Clerk of Works.
Address C., 11, Upper North Street, Poplar, LONDON.

WANTED, a Gas Stoker, used to Shovel Charging, Engine and Exhauster. Permanency to an active and steady Man. Wages 30s. per week.
Apply to S. BARK, Gas Office, SUNBURY-ON-THAMES.

STOKER wanted, used to Scoop or Shovel Charging. Must be a good Furnace Man. Wages 30s. to 32s. per week. Good Character indispensable.
Apply to the MANAGER, Gas-Works, GRAYS.

DRAUGHTSMAN wanted. One used to Elevating and Conveying Machinery and General Gearing. To commence duties at once.
Apply, stating Age, Salary, and Experience to GRAHAM, MORTON, AND CO., Black Bull Street, LEEDS.

WANTED, at once, a good and reliable WORKING FOREMAN for Retort-House and Yard. Must be used to Regenerative Firing, &c. Preference to one able to do Works Fitting. Wages 33s.
Also, a good and steady LEADING STOKER, used to Regenerators, Engine, &c. Wages 30s.
Works 32 millions, about 30 miles from London.
Apply, by letter, to No. 3406, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TRAVELLER wanted for London, to REPRESENT WHOLESALE GAS-FITTINGS WAREHOUSE.
Apply, stating full Particulars of previous Experience, Age, Salary, &c., to No. 3405, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SHARPNESS DOCKS GAS COMPANY.
WANTED, a good stoker, used to shovel Charging. Constant berth to a suitable Man. Six Retorts in Winter, Four in Summer. Wages to commence 22s. per week.
Apply to the MANAGER, Gas-Works, SHARPNESS DOCKS.

DRAUGHTSMAN wanted, accustomed to Gas-Works Construction and Plant. Good knowledge of General Building Construction, Structural Ironwork, and able to take out Stresses.
Apply, stating Age, Experience, and Salary required, to ENGINEER, Gas and Water Department, RAMSGATE.

WANTED, at once, a First-class DRAUGHTSMAN experienced in Gas-Works Construction and Estimating Quantities.
Apply, giving full Particulars as to Age, Experience, and Salary required, with *copies* of Testimonials to
J. H. BROWN.
Gas-Works, Ilford, E.

COOKING AND HEATING BY GAS.
WANTED, by a Foreign Gas Company, a thoroughly competent MAN to take entire charge of the above Departments. Three years' contract. Salary to commence with, £250.
Applications, with full details, to No. 3404, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

INCANDESCENT LIGHTING.
WANTED, a Gentleman with Commercial Ability and Experience to ASSIST IN MANAGEMENT of new Company. No one without thorough knowledge of the Trade need apply.
Full Particulars, with Salary required, and *copies* of Testimonials, to No. 3407, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN wanted, one who thoroughly understands Gas-Works Construction and Plant, with good knowledge of General Building Construction, Constructional Ironwork, and Strains and Stresses.
Apply, stating Age, Experience, and Salary required, sending *copies* of three Testimonials to No. 3408, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

LUTON GAS COMPANY.
GAS-FITTER.
WANTED, immediately, a smart, energetic Man of good address who thoroughly understands Main and Service Laying, Meter, Stove, and Incandescent Burner Fixing.
State Age, Experience, Salary required, and send *copies* of three Testimonials, to
W. R. PHILLIPS,
Manager and Engineer.
Gas Company's Office, Luton.

MERTHYR TYDFIL GAS COMPANY.
WANTED, a competent young Man as INSPECTOR of METERS and ASSISTANT CLERK in the Gas-Fittings Department. Wages 25s. per week.
Applications, in own Handwriting, stating Age, where last employed, and enclosing *copies* only of Three recent Testimonials as to Character and Experience, to be addressed to the undersigned not later than Saturday, the 20th inst.
JOHN L. COCKER,
Secretary and General Manager.
Gas Office and Works, Merthyr Tydfil,
Glamorganshire, Jan. 2, 1900.

THE Bingley District Council desire to receive APPLICATIONS for the post of GAS ENGINEER AND MANAGER of the Gas-Works at Bingley. The person appointed will be required to devote the whole of his time to the services of the Council, and to commence his duties on the 1st of April next.
The Output of Gas from the Bingley Works is from 80 to 90 million cubic feet per annum.
Written Applications, with Testimonials, and stating Age and Qualifications of Applicants, and Salary required, and marked "Gas Manager," must be sent to the Chairman of the Gas Committee, Town Hall, Bingley, not later than the 12th of January, 1900.
ALFRED PLATTS,
Clerk to the Council.
Town Hall, Bingley.

URBAN DISTRICT COUNCIL OF BUXTON.
GAS MANAGER.
THE Urban District Council of Buxton require an experienced MANAGER for their Gas-Works.
Candidates must have a thorough knowledge of the Manufacture, Testing, and Distribution of Gas, the Working of Generator and Regenerative Furnaces, and all Residuals. They must be competent, and will be required to design and carry out Extensions on the most approved and modern principles.
Salary £200 per annum, with House, Coal, Gas, and Water free.
Applications, with *Copies* of three recent Testimonials, to be addressed to the Chairman of the Gas Committee, on or before the 15th day of January next, endorsed "Gas Manager."
By order,
JOSIAH TAYLOR,
Clerk to the Council.
Town Hall, Buxton,
Dec. 29, 1899.

WANTED, for a London Gas Company, a JUNIOR RENTAL CLERK. Must be quick at figures, and accustomed to the work. Salary to commence at £80 per annum.
Apply by letter in the first place, addressed GAS RENTAL CLERK 63, CHANCERY LANE. Would be required to begin work about the first week in February, 1900.

IRON ROOF for Sale, 132 feet long by 53 ft. 4 in. Span, in first-class condition.
Apply to CLAYTON, SON, AND CO., LIMITED, Hunslet, LEEDS.

ENGINES and Exhausters, from 3500 to 30,000 cubic feet per hour, in Stock, ready for delivery. No reasonable offer refused.
J. F. BLAKELEY, Thornhill, DEWSBURY.

LIVESEY Washer, 1 Million per diem, 18-inch Valves. MORRIS & CUTLER'S CONDENSER, 18-inch Valves. All in perfect order, and cheap.
J. F. BLAKELEY, Thornhill, DEWSBURY.

RETORT IRONWORK.
RIVETED Wrought-Iron U Hydraulic MAINS, with 5-inch Pipes, 20 in. by 15 in., and 21 in. by 15 in. ∩ MOUTHPIECES, in sets of six and seven, complete. Equal to new, and cheap.
J. F. BLAKELEY, Thornhill, DEWSBURY.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

TENDERS FOR GAS COAL.
THE Magistracy of Copenhagen are prepared to receive TENDERS for the supply and delivery of 140,000 Tons of Best GAS COAL during the Year 1900, from April to the end of December.
The Magistracy reserve the right to divide the Contract between two or more Contractors.
Further Information, and Conditions for the delivery, can be obtained on application to Kobenhavns Belysningsvoesen, Vestre Boulevard, Kjobenhavn, V.
The Tenders should be under sealed envelope, marked "Tilbud paa Kul," and be sent to Magistratens 4de afdeling Lavendelstraede No. 1 Kjobenhavn K, on or before the 15th of January, 1900, Twelve o'clock, at which time the Tenders will be opened in the presence of the parties tendering who may be present.
THE MAGISTRACY OF COPENHAGEN.
Dec. 19, 1899.

THE Gas Committee of the Corporation of Heywood are prepared to receive TENDERS for the supply of FIRE-CLAY GOODS.
Specification, Quantities, and Form of Tender may be obtained upon application to Mr. W. Whatmough, Gas Manager.
Contractors tendering for this work must pay their workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of work for which the Tender is sent in.
Tenders, endorsed "Fire-Clay Goods," to be sent to me not later than Tuesday, Jan. 16, 1900.
By order,
J. H. BALDWICK,
Town Clerk.
Municipal Buildings, Heywood,
Dec. 20, 1899.

SCUNTHORPE GAS-WORKS.
CONTRACTS Nos. 1 & 2.
THE Urban District Council of Scunthorpe (Lincolnshire) are prepared to receive TENDERS for the construction and erection of the BUILDINGS and PLANT at their Gas-Works.
Copies of the Specification and the Drawings can be seen on and after Friday, the 5th day of January, 1900, at the Office of the Clerk to the Council, or at the Office of the Engineers, Messrs. Stevenson and Burstal, 38, Parliament Street, Westminster.
Copies of the Tender and Bill of Quantities can be obtained from the above-mentioned on payment of Two Guineas each, which will be returned upon receipt of a *bonâ-fide* Tender.
Sealed Tenders, endorsed in accordance with the instructions at the head of the Tender, to be delivered to the undersigned, not later than Wednesday, the 17th day of January, 1900.
(Signed) F. C. HETT,
Clerk to the Council.

CRYSTAL PALACE DISTRICT GAS COMPANY.
SALE BY TENDER OF £20,000 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.
MINIMUM PRICE, £150 PER CENT.
NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL, BY TENDER, £20,000 of FIVE PER CENT. PERPETUAL DEBENTURE STOCK, in accordance with the provisions of the Crystal Palace District Gas Act, 1893 (56 and 57 Vic.).
Particulars of same, with Form of Tender, can be obtained at this Office on application to the undersigned; and Tenders must be sent in on or before Thursday, the 18th day of January, 1900.
The Stock will be allotted to the highest bidders; but no Tender will be accepted at a lower price than at the rate of £150 money for each £100 Debenture Stock.
By order of the Board,
CHARLES M. OHREN,
Secretary.
Offices and Works: Lower Sydenham, S.E.,
Dec. 15, 1899.

SKIPTON URBAN DISTRICT COUNCIL
(GAS DEPARTMENT.)

TENDERS FOR OXIDE OF IRON.

THE Council invite Tenders for the supply of 100 Tons of Natural OXIDE OF IRON, to be delivered at the Gas-Works, Skipton, free of carriage.

Sealed Tenders, stating times of delivery, are to be sent to me on or before Tuesday, Jan. 9, 1900.

The Council do not bind themselves to accept the lowest or any Tender.

RICHARD WILSON,
Clerk to the Council.

Dec. 21, 1899.

SKIPTON URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Council invite Tenders for the supply of 1000 Tons of best screened GAS COAL, to be delivered in quantities of about 250 Tons each during each of the four weeks commencing the 8th of January next.

Tenders, marked "Tender for Coals," and stating Price including delivery at Skipton Railway Station, and at the Wharf on the Leeds and Liverpool Canal adjoining the Works, are to be sent to me on or before Friday, the 5th of January next.

The Council do not bind themselves to accept the lowest or any Tender.

No Forms of Tender supplied.

RICHARD WILSON,
Clerk to the Council.

Skipton, Dec. 28, 1899.

COUNTY BOROUGH OF BURY.

TO RETORT & FIRE-BRICK MANUFACTURERS.

THE Gas Committee are prepared to receive TENDERS for RETORTS, FIRE-BRICKS, and FIRE-CLAY required at their Gas-Works.

Forms of Tender may be obtained from Mr. H. Simmonds, Engineer and Manager, Gas-Works, Elton, Bury.

Tenders, sealed and endorsed "Tender for Retorts, &c.," to be sent to the undersigned not later than Monday, the 15th of January, 1900.

JOHN HASLAM,
Town Clerk.

Corporation Offices, Bank Street,
Bury, Dec. 29, 1899.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
GUILDFORD GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £5000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 16th of January, 1900, at Two o'clock.

Particulars of the AUCTIONEER, as above.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 600 £10 ADDITIONAL ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 16th of January, 1900, at Two o'clock.

Particulars of the AUCTIONEER, as above.

By order of the Directors of the
WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £3000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Tuesday, the 30th of January, 1900, at Two o'clock, in Lots,

£3000 OF NEW ORDINARY STOCK IN THE ABOVE UNDERTAKING,

Ranking for a Standard Dividend of 7 per Cent., subject to the Sliding-Scale; the last Dividend on similar Stock in the Company having been 12½ per cent.

Particulars of the AUCTIONEER, as above.

JAMES OAKES & CO.

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

WILL BE READY ON FRIDAY NEXT,

Demy Octavo, 172 Pages, Bound in Dark Blue Cloth, Lettered, Price 6s., post free,

THE

"POWERS OF CHARGE"

of the

METROPOLITAN GAS COMPANIES:

A HISTORY OF THE QUESTION OF PRICE IN LONDON

FROM THE INTRODUCTION OF GAS LIGHTING TO THE PRESENT TIME.

BY

LAURENCE W. S. ROSTRON,
M.A., B.C.L.,
Of New College, Oxford, and Lincoln's Inn,
BARRISTER-AT-LAW.

WITH A PREFACE BY

GEORGE LIVESEY, M.Inst C.E.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

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Price 2s. each.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH N.B.

HOLMSIDE

GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . .	11,205 Cubic Feet.
Illuminating Power	16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR

PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

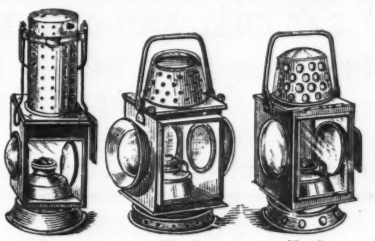
These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

ARMSTRONG'S PATENT

CANDLE SAFETY LAMPS.



No. 1. No. 2. No. 3.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

WELDON MUD

FOR

GAS PURIFICATION,

For use in the

RECOVERY OF SULPHUR,

ALSO

Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:

GAS DESULPHURIZATION CO.,

— LIMITED. —

1, FENCHURCH AVENUE, LONDON, E.C.

THE

"MALL" LANTERN

Absolutely the STRONGEST and CHEAPEST Lantern in the Market.

WINDPROOF & SHADOWLESS.

Adopted for Lighting ST. JAMES'S PARK *and around* BUCKINGHAM PALACE.

WILLIAM EDGAR,

GAS ENGINEER,

Blenheim House, HAMMERSMITH, W.

Telegrams: "GASOSO, LONDON."
Telephone: 14 HAMMERSMITH.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

ADDRESS CHIEF OFFICES:

Temple Buildings, 50, New Street, Birmingham.

OSLER,

BIRMINGHAM.

MANUFACTURERS OF GASELIERS IN GLASS AND METAL.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY

RAVENSTHORPE, NEAR DEWSBURY

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per Ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to

W. H. PARKINSON,

THE HARTON COAL CO., LTD.,

NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON, NEWCASTLE."

THE PATENT

"BEACON" GLOBE LAMP.

As fitted at London Bridge near Railway Approach; three Lamps giving the Illuminating Power of 600 Candles. See Surveyor's Report as published in the "*JOURNAL*" for Jan. 10, 1899.

H. GREENE & SONS, Ld.

Late of Cannon Street,

19, FARRINGDON ROAD, E.C.

Telegrams: "LUMINOSITY, LONDON."

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars Price, &c., apply to Mr. EDWARD PRICE, 119, Queen's Road, FINSBURY PARK, N.

Prices are Reduced.

GAS-FITTINGS.

BURNERS

Welsbach Pattern

per 7/6 Doz.

WRITE FOR CATALOGUE.

WHOLESALE FITTINGS COMPANY

80, Commercial Road, London, E.

INCANDESCENT.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI LONDON, W.C.

THOMAS DUXBURY & CO.,

16, DEANSGATE, MANCHESTER.

GAS ENGINEERS' AGENTS AND CONTRACTORS FOR

Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.

Inquiries Solicited.

Telegrams: "DARWINIAN, MANCHESTER." Telephone 1806.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

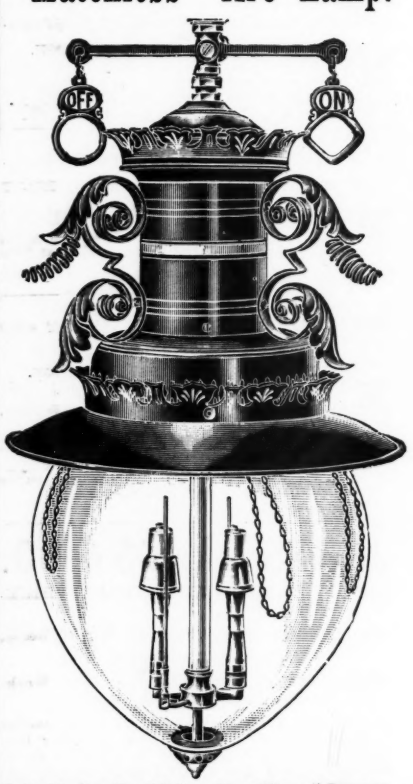
For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

THE

"Matchless" Arc Lamp.



Suitable for the "C" or the "Kern" Burner.

PRICE LIST ON APPLICATION.

J. & W. B. SMITH,

21 & 23, FARRINGDON ROAD, E.C.

PUBLIC CAUTION!

ON THE 21ST OF DECEMBER AN ORDER WAS MADE

in the High Court, in the pending Action of the

WELSBACH INCANDESCENT GAS-LIGHT CO., LTD.,

against the

VOELKER INCANDESCENT MANTLE, LTD.,

RESTRAINING

the Latter, their Servants, and Agents from

Infringing the Patent Rights

of the Welsbach Company until the trial of the Action.

Any **EXHIBITION, SALE,** or **USE** of the **VOELKER MANTLE** will render all concerned liable to Proceedings for Contempt of Court, for Breach of the said Order.

The Trade and the Public are warned against the

INFERIOR IMITATIONS OF THE NEW WELSBACH (KERN) BURNER

lately placed upon the Market. **All Dealers and Users** of the

NEW WELSBACH (KERN) BURNER

are requested to ignore the Newspaper Threats of the New Sunlight Incandescent Company, Ltd., and, in case of an Action being brought, to at once communicate with the Welsbach Company, who, upon receipt of the Writ, are prepared to take the Defence of the Action into their own hands, and to Indemnify the person attacked from all consequences.

MANTLES.

Dealers and Users are also **Warned** not to believe the rumours circulated by Infringers, that the Company's Patent Rights expire shortly. These

RIGHTS EXIST UNTIL 1907;

and the Company will continue to uphold their rights, and to Suppress all Infringements of Mantles as well as of Burners.

The Company are doing their best to accelerate the Action now pending in respect of the

SUNLIGHT COMPANY'S WHITE MANTLE,

which, it is claimed, is an

INFRINGEMENT OF THE WELSBACH PATENTS.

Dealers and the Public are cautioned against Buying, Selling, or Using the said Mantle.

The Welsbach Incandescent Gas-Light Co., Ltd.

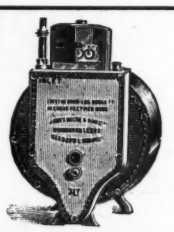
76-80, YORK STREET, WESTMINSTER, LONDON, S.W.

NITRATE of Thorium and Cerium.
FABRIK CHEMISCHER PRAEPARATE VON STHAMER NOACK, AND CO., HAMBURG.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.
LONDON OFFICE: R. CULL, 34, OLD BROAD STREET, E.C.

LONDONDERRY GAS COALS
FROM THE
LONDONDERRY COLLIERIES,
COUNTY OF DURHAM.
Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal
as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR,
COUNTY OF DURHAM.

THOMAS TURTON
AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
99, CANNON STREET, E.C.

JAMES MILNE & SON, LTD.,
GAS ENGINEERS
MILTON HOUSE WORKS EDINBURGH.
LONDON. —— LEEDS. —— GLASGOW.


WORKMANSHIP and MATERIALS
OF THE HIGHEST
QUALITY.
PECKETT'S
LOCOMOTIVES
Built to any
Specification or Gauge.
PECKETT & SONS, Atlas Locomotive Works, BRISTOL.

JOHN BROWN & CO., LTD., SHEFFIELD,
Proprietors of
ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 Feet of 19-Candle Gas per Ton.
Value in Pounds of Sperm, 820·80.
VERY FREE FROM IMPURITIES.
TELEGRAMS: "ATLAS, SHEFFIELD."

INCLINED RETORTS
UP-TO-DATE FURNACES
AND SETTINGS.
J. & H. ROBUS, 20, Bucklersbury, London, E.C.

NEW SUNLIGHT INCANDESCENT COMPANY, LIMITED,

33 & 34, SHOE LANE,

LONDON, E.C.,

Dec. 28, 1899.

SUNLIGHT WHITE MANTLES.

Dear Sir,

Referring to an advertisement of the Welsbach Company which has just appeared claiming that it "is doing its best to accelerate the action against our White Mantle," we beg simply to state that, having asked the permission of the Court to administer certain interrogatories to the Company and its servants - the fairness of which has, of course, to be judged by the Court before we administer them - we have been met by an announcement that the Welsbach Company's officials will refuse to answer these interrogatories, and will take this preliminary point up to the House of Lords. This is what is termed "accelerating the action."

We take this opportunity, however, to remind our customers that, with every mantle we sell, we are prepared to give the most ample guarantee to the buyer.

We would further remind the Trade generally of the great risk they are running in dealing in the Kern (new Welsbach) Burner. We have commenced actions both for the revocation of the Kern Patent, and for infringement by the Welsbach Company of our DeMare Patent, which Kern attempted to purchase "in order to protect the Kern Patent."

Should any general Reduction take place in the Prices of our Burners or Mantles, full credit will be granted on Stocks in the hands of our Agents or the Trade, if ordered subsequent to the date of this announcement.

NEW SUNLIGHT INCANDESCENT COMPANY, LTD.,

L'ce Fletcher,

Secretary.

THE

"KITSON" LIGHT

A SYSTEM OF BURNING VAPOURIZED PETROLEUM WITHIN AN INCANDESCENT MANTLE.

A Light of 1000-CANDLE POWER produced at a cost of less than

ONE PENNY PER HOUR.

STREET-LAMPS—Self-Contained Plant, easily fixed, no tearing up of Thoroughfares.

INSTALLATIONS for Works, Factories, Warehouses, Railway Stations, and Sidings.

SPECIAL TERMS TO GAS COMPANIES.

FOR PRICES AND PARTICULARS, APPLY TO THE

KITSON LIGHTING & HEATING SYNDICATE, Ld.

1, VICTORIA EMBANKMENT (New Bridge Street), LONDON, E.C.

REGISTERED OFFICE: 137, Victoria Road, DARLINGTON.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

Midland and West of England District Office: 6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.

Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.

London District Office: 6, STRAND, LONDON—C. PARKER & SON, Sole Agents.

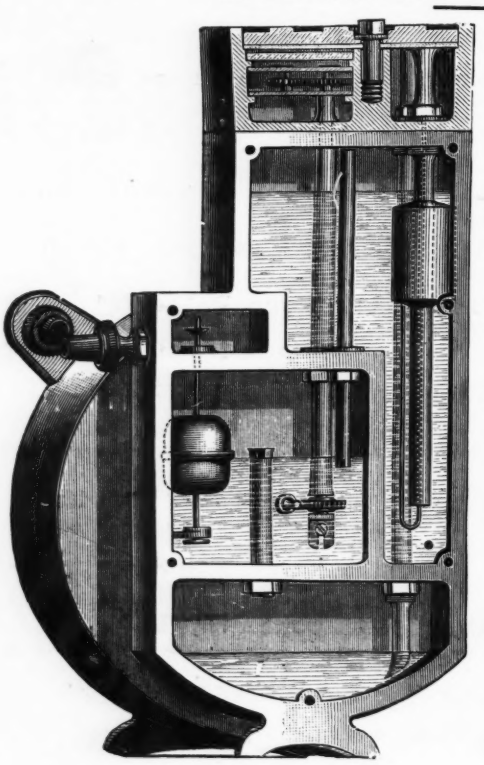
Telegraphic Address: "PARKER, LONDON."

ALDER AND MACKAY,

MANUFACTURERS OF

IMPROVED WET AND DRY GAS-METERS

IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.



Sole Makers of Green's Patent Underground Wet Gas-Meters for Street Lighting, &c., and Ogden's Patent Spindle Tube for Wet Gas-Meters.

GREEN'S PATENT
UNDERGROUND METER

Has been designed to obviate that which has hitherto prevented the general adoption of underground Meters—namely, their serious cost. No box is required; and the saving thus effected as compared with ordinary underground Meters, where either a box or meter-pillar is necessary, is fully one-half. The price of one for three lights is 28s.; and the other sizes are correspondingly cheap. When fixed, the only part of the Meter exposed to view measures 6½ inches by 3½ inches. By the Indicator with which the Meter is fitted, the Inspector can at once discern whether water is required; but as the Meter is of the compensating description, water will probably need only be supplied ONCE A YEAR. It is advisable to fill the Meter with a non-freezing liquid which does not injure the fittings; and this can be supplied at about 1s. 3d. per gallon.

Prices and all Information on Application.

NEW GRANGE WORKS, EDINBURGH.

HIGHEST AWARDS given for our WET and DRY METERS at

Exhibitions held at GLASGOW, CALCUTTA, and EDINBURGH.

THE

DENAYROUZE LIGHT SYNDICATE

LIMITED,

28, VICTORIA ST., WESTMINSTER, S.W.

THE PIONEERS

OF INCANDESCENT BURNERS

WITHOUT CHIMNEYS.

The "SMALL TORCH" Burner (Bandsept Patent) for Street Lighting, consuming 3½ feet of Gas per hour. Having an efficiency of 25-Candle Power per Cubic Foot of Gas consumed, it is not only the BEST but CHEAPEST Intensive CHIMNEYLESS Burner on the Market.

PRICE COMPLETE WITH MANTLE

4s. 9d.

All other Burners supplied by the Syndicate proportionately Reduced from January 1, 1900, full Particulars of which will shortly be issued to the Trade, and followed by new and complete Catalogue.

NOTE—THE DENAYROUZE LIGHT SYNDICATE has carried out the work in connection with all the Installations of Van Vriesland's Oil Gas in England, together with the entire work and fitting of the Grand Exhibit in North West Gallery for the Gas and Allied Trades Exhibition to be held at the Royal Aquarium, Westminster, from Dec. 21, 1899, to Jan. 23, 1900, where all their Burners can be seen in operation.

ARROL-FOULIS
PATENT HYDRAULIC MACHINERY
FOR
CHARGING AND DRAWING GAS-RETORTS

SIR WILLIAM ARROL & CO., Ltd., Sole Makers,
DALMARNOCK IRON-WORKS, BRIDGETON,
GLASGOW.

LONDON ADDRESS: 32, VICTORIA STREET, WESTMINSTER, S.W.

PLANS AND ESTIMATES FURNISHED ON APPLICATION.

THE
ARROL-FOULIS
MACHINES
Are Employed at the following Works—

GLASGOW GAS-WORKS—
Tradeston.
Dawsholm.
Dalmarnock.

GASLIGHT & COKE COMPANY—
Beckton.

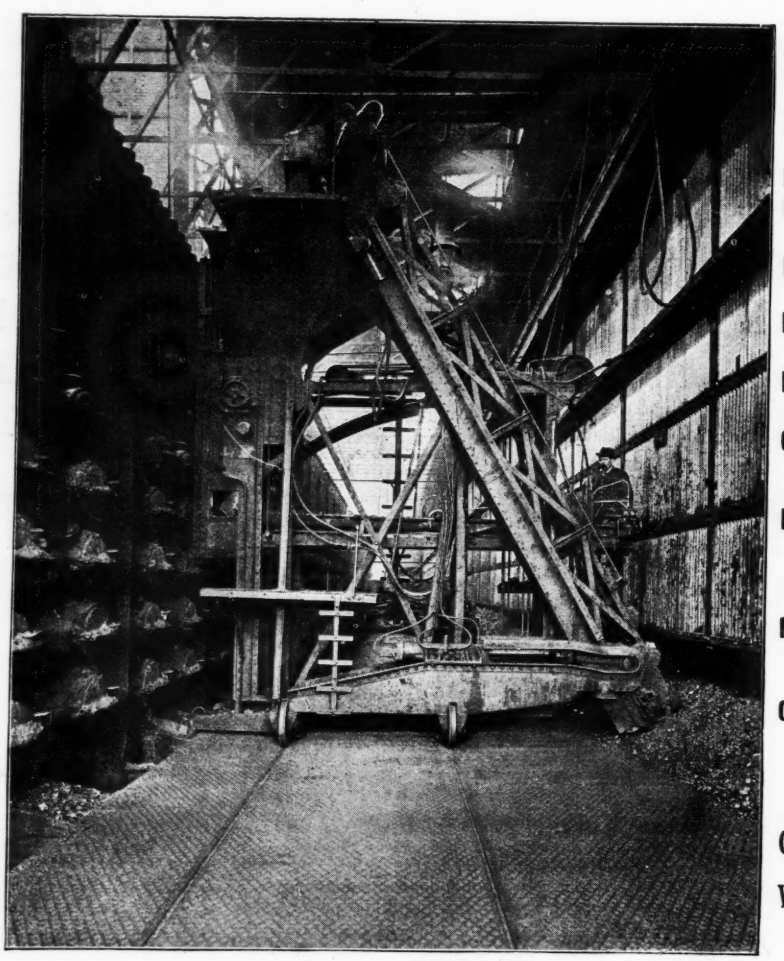
SOUTH METROPOLITAN GAS COMPANY—
East Greenwich
Vauxhall.
Rotherhithe.

COMMERCIAL GAS-WORKS—
Wapping.
Poplar.

BROMLEY GAS-WORKS (KENT).

EDINBURGH GAS-WORKS.

LIVERPOOL GAS-WORKS.



ROTHERHITHE GAS-WORKS.

THE
ARROL-FOULIS
MACHINES
Are Employed at the following Works—

LEEDS GAS-WORKS.

BIRMINGHAM GAS-WORKS.

BRITISH GAS CO.—
Hull.

BOLTON GAS-WORKS.

IMPERIAL CONTINENTAL GAS ASSOCIATION—
Amsterdam.
Vienna.

HAGUE CORPORATION GAS-WORKS—
Hague.

METROPOLITAN GAS-WORKS—
Melbourne.

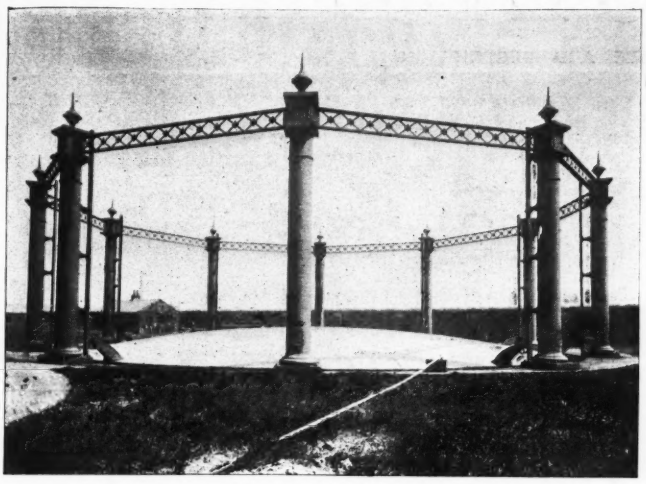
CLEVELAND GAS-WORKS—
Cleveland, Ohio,
&c., &c., &c.

OVER 200 MACHINES ARE AT WORK OR IN COURSE OF CONSTRUCTION.

THE TIME TAKEN TO DRAW AND CHARGE EACH RETORT BY THESE MACHINES AVERAGES

ONE MINUTE.

GASHOLDERS



A GASHOLDER

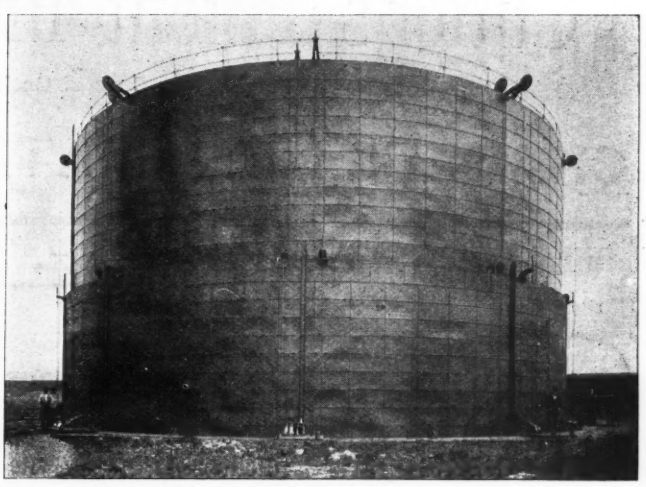
Guided by Ten massive Cast-Iron Columns and Girders is shown in the accompanying Photo.

AS IT WAS

originally erected by us

IN 1883.

We have this year taken down the Guide-Framing, converted the Holder into a Two-Lift; and this Photo. ☛ shows it



AS IT IS NOW

entirely guided by our Patent Steel Cable System.

In many other instances, Columns have been sold and replaced by our Cables.

We are prepared to alter any Holders in a similar manner to the above. Engineers who have trouble with the irregular working of Column-Guided Holders will find the Cable System vastly superior and quite reliable.

PATENTEES AND SOLE MANUFACTURERS:

ASHMORE, BENSON, PEASE, & CO., LTD.

GAS AND ELECTRICAL ENGINEERS,

MANUFACTURERS OF

Accumulators, Complete Installations for Light and Power, Gasholders (with and without Columns), Purifiers, Scrubbers, Condensers, Washers, Roofs, Girders, Sulphate Plants, Valves, &c., &c.

London Office:	*Telegrams:*	*Paris Office:*
181, QUEEN VICTORIA STREET, E.C.	"Gasholder, Stockton-on-Tees." "Apparatus, London."	3, SQ. DES BATIGNOLLES.

S. CUTLER AND SONS, MILLWALL, LONDON.

GASHOLDERS

OF EVERY SIZE AND DESCRIPTION.

CUTLER'S PATENT GUIDE-FRAMING HAS BEEN ADOPTED FOR MANY IMPORTANT HOLDERS.

Carburetted Water-Gas Plant.

SPECIAL DESCRIPTIVE CATALOGUE ON APPLICATION.

PATENT WATER-TUBE CONDENSER

Over 120 now in use.

Cutler's Patent Freezing Preventer

For keeping Cups of Gasholders free from Ice.

CHARLES HUNT PATENT GAS-WASHER.

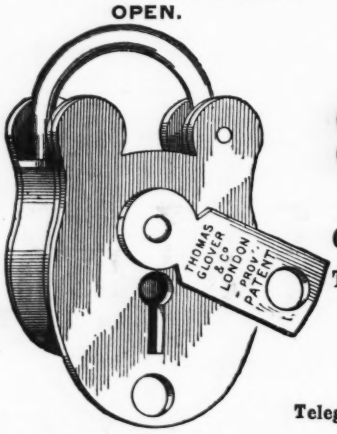
ESTABLISHED 1844. **ORIGINAL MAKERS.** **ESTABLISHED 1844.**

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;

The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.

OPEN.



THOMAS GLOVER & CO.'S

PATENT

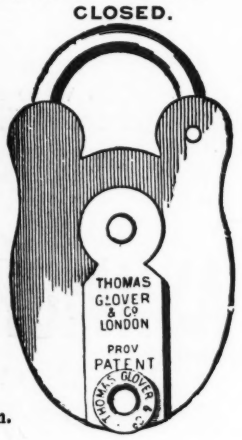
SECURE PADLOCK

PREVENTS TAMPERING WITH THE

CASH-BOXES OF PREPAYMENT METERS.

The Padlock is Sealed by means of a Lead Eyelet, which is impressed with Company's private mark. Eyelets easily fixed and removed by Company's Collector.

CLOSED.



Telegraphic Address: "GOTHIC, LONDON." Telephone No. 725, Holborn.

THOMAS GLOVER & CO., LTD.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN, LONDON, E.C.

BRISTOL: 28, BATH STREET. *Telegraphic Address: "GOTHIC."* **Telephone No. 1005.**

BIRMINGHAM: 1, OOZELLS STREET. *Telegraphic Address: "GOTHIC."*

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address: "GOTHIC."* **Telephone No. 3398.**

GLASGOW: ARGYLE WORKS, KINNING PARK. *Telegraphic Address: "GASMAIN."* **Telephone No. 1825 South Side.**

HARPER & MOORES,
STOURBRIDGE.

MANUFACTURERS OF

BEST FIRE-BRICKS, GAS-RETORTS,
LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.

Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

Manufacturers of Glasshouse Pots and Crucibles of every kind.
Established 1836.

JOSEPH CLIFF & SONS,
INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.
WORTLEY, LEEDS.

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16, Lightbody Street.
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Queen Street.

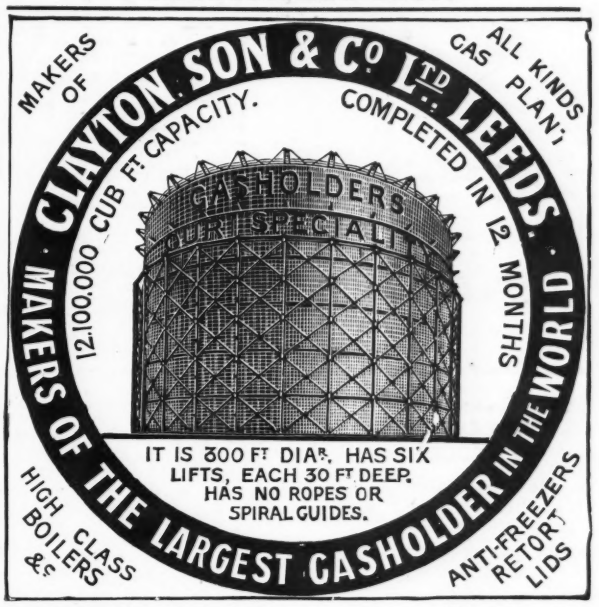
MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
Established 1860.


MAKERS OF
CLAYTON, SON & Co LTD LEEDS.
ALL KINDS GAS PLANT
COMPLETED IN 12 MONTHS
12,100,000 CUB FT CAPACITY.
GASHOLDERS
SPECIALITY
IT IS 300 FT DIAR. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
HIGH CLASS BOILERS &c
ANTI-FREEZERS RETORT LIDS

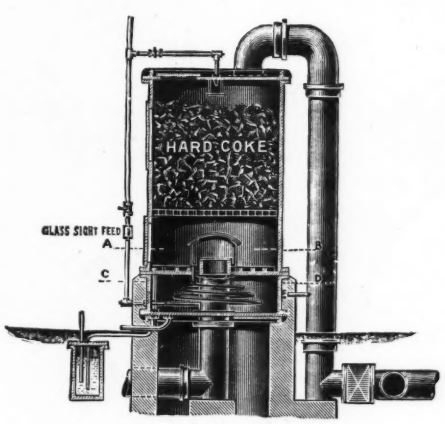
GIRDERS, ROOFS, & ALL KINDS OF STRUCTURAL IRONWORK.

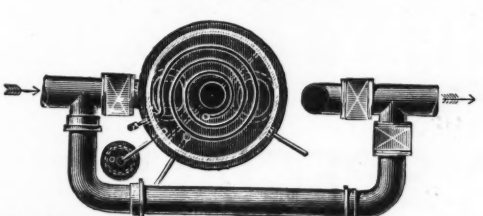
London Office: 60, QUEEN VICTORIA STREET, E.C.
Telegraphic Addresses: "GAS, LEEDS." "ECLABAGE LONDON."

R. & J. DEMPSTER, LTD., GAS PLANT WORKS,

Telegraphic Address: "SCRUBBER, MANCHESTER." National Telephone: Nos. 54 and 2296.

NEWTON HEATH, MANCHESTER.





Sole Makers of

CRIPPS' PATENT
CARBURETTOR

FOR ENRICHING COAL GAS, AND FOR

DISSOLVING AND PREVENTING NAPHTHALENE DEPOSITS

IN GAS-MAINS.

PRICES ON APPLICATION.

London Office: 165, Gresham House, Old Broad Street, E.C.

SERVICE CLEANER.

HUTCHINSON BROS. & CO., LTD.

GAS ENGINEERS, &c.,

MANUFACTURERS OF IMPROVED

WET AND DRY GAS-METERS.

STATION-METERS. LAMP-METERS.

TEST GASHOLDERS & GENERAL GAS APPARATUS.

BRASS MAIN & LAMP TAPS. UNIONS, FERRULES, &c.

The "Falcon" Lamplighter's Torch. Service Cleaners.

SYPHON AND OTHER PUMPS.

Wood and Wrought-Iron Purifier-Grids. Scrubber Boards

WET AND DRY METERS REPAIRED.

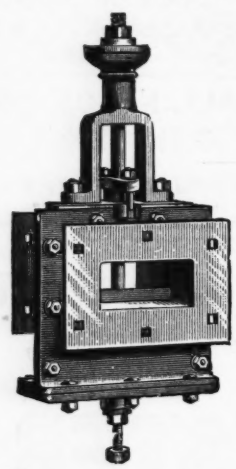
FALCON WORKS, BARNSLEY.

Telegrams: "HUTCHINSON BROS., BARNSLEY."

LAMP SERVICE CLEANER.

Telegraphic Address:
"CLAPHAM BROS., KEIGHLEY."

National Telephone
No: "KEIGHLEY 35."



"TRADE FOLLOWS THE FLAG"

CLAPHAM BROTHERS LTD

KEIGHLEY, YORKS. ESTABLISHED 1857

"SPECIALTIES"

London Representative:
THOMAS B. YOUNGER., C.E.
CHESTERFIELD HOUSE, 98, GREAT TOWER STREET.

Contractors to Her Majesty's Government.

WELLINGTON, NELSON, AND MARKET STREET WORKS.

LONDON OFFICE:

TELEGRAPHIC ADDRESS:
"DRAKESON, HALIFAX."

34, VICTORIA ST., WESTMINSTER, S.W.

TELEPHONE No. 43
"HALIFAX EXCHANGE."

GAS ENGINEERS.
CONTRACTORS.
IRONFOUNDERS.

JONAS DRAKE & SON

SOLE AGENTS FOR

HISLOP'S

PATENT REGENERATIVE FURNACES

— FOR —

ENGLAND, WALES & ABROAD.

RETORT BENCHES ERECTED COMPLETE WITH OR WITHOUT SPECIAL FURNACES.

RESULTS GUARANTEED.

OVENDEN HALIFAX

RETORT SETTERS.
FURNACE BUILDERS.
ETC. ETC.

Designs and Estimates on Application.

GASEOUS FIRING A SPECIALTY.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Jan. 2, 1900.